PREFACE

The U.S. Army Engineer Waterways Experiment Station (WES) is a Corps of Engineers research complex consisting of five (5) laboratories: Coastal and Hydraulics Laboratory, Geotechnical Laboratory, Structures Laboratory, Environmental Laboratory and Information Technology Laboratory. WES is responsible for conducting basic research in the broad fields of hydraulics, rehabilitation of hydraulic structures, coastal engineering, instrumentation, oceanography, remote sensing, earthquake engineering, soil dynamics, concrete, expedient construction, nuclear and chemical explosion effects, vehicle mobility, self-contained munitions, military hydrology, fixed installation camouflage, environmental impact, environmental engineering, geophysics, pavements, protective structures, aquatic plants, water quality, dredged material, computer science, telecommunications management and business automation, graphic arts and printing, library services, and records management. This research is conducted by Government personnel and by contract with educational institutions, non-profit organizations and private industries.

The provisions of the Competition in Contracting Act of 1984 (P.L. 98-369) as implemented in the Federal Acquisition Regulation provide for the issuance of a Broad Agency Announcement as a means of soliciting proposals for basic and applied research and that part of development not related to the development of a specific system or hardware procurement. This announcement must be general in nature, identify the areas of research interest, include criteria for selecting proposals, and solicit the participation of all offerors capable of satisfying the Government's needs. The proposals submitted under this Broad Agency Announcement will be subject to peer or scientific review. Proposals that are selected for award are considered to be the result of full and open competition and in full compliance with the provisions of PL 98-369, "the Competition in Contracting Act of 1984".

This guide constitutes the Broad Agency Announcement of this Command and conforms with regulatory requirements of the Federal Acquisition Regulation. This guide provides prospective offerors information on the preparation of proposals for basic or applied research. Suggestions as to form and procedures are included.

Offerors shall submit a brief letter pre-proposal not to exceed five pages addressing (i) the major research thrust; (ii) the technical approach; (iii) the research goals; (iv) total estimated cost and relevancy to the research described herein. Pre-proposal inquiries will be responded to within 60 days of receipt, either encouraging submission of a complete proposal or advising the offeror not to submit.

Persons contemplating submission of a proposal are also encouraged to contact the appropriate WES scientist identified in this publication to ascertain the extent of interest which WES may have in a specific research project.

Proposals from U. S. Government facilities and organizations will not be considered under this program announcement. Additionally, requests for conference and symposium support are exempt from this announcement.

All pre-proposals and proposals regarding this Broad Agency Announcement should be submitted to the **U.S. Army Engineer Waterways Experiment Station, ATTN CEWES-CT-Z, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199**, and should reference this announcement. Reference must be made to the code number for the specific research area. These code numbers are listed at the end of each topic (e.g., CHL-1, ITL-2).

PERSONS SUBMITTING PROPOSALS ARE CAUTIONED THAT ONLY A CONTRACTING OFFICER MAY OBLIGATE THE GOVERNMENT TO ANY AGREEMENT INVOLVING EXPENDITURE OF GOVERNMENT FUNDS.

This Broad Agency Announcement supersedes the November 1995 edition and shall remain in effect until superseded.

WES encourages Historically Black Colleges and Universities (HBCUs), Minority Institutions (MIs), small business concerns, women owned businesses, and small disadvantaged business concerns to submit research proposals for consideration.

The Bidder/Offeror, by submission of a bid or offer or execution of a contract in response to this solicitation, certifies that the Bidder/Offeror is not debarred, suspended, declared ineligible for award of public contracts, or proposed for debarment pursuant to FAR 9.406-2. If the Bidder/Offeror cannot so certify, or if the status of the Bidder/Offeror changes prior to award, then the Bidder/Offeror must provide detailed information as to its current status.

NOTE: PREPARATION INSTRUCTIONS AND ADDRESS SHOWN ON PAGES 60-63

TABLE OF CONTENTS

PART I

BACKGROUND AND RESEARCH INTERESTS

BACKGROUND

The U.S. Army Engineer Waterways Experiment Station (WES) was established by Congress in 1929 after the disastrous Mississippi River flood of 1927. Over the years, the mission of the small hydraulics laboratory has been expanded to include a wide variety of disciplines under the auspices of a six laboratory complex. This makes WES the largest research facility within the Corps of Engineers. Permanent and wholly owned facilities are located at the 680 acre U.S. Army Engineer Waterways Experiment Station at Vicksburg, Mississippi and the 175 acre Field Research Facility at Duck, North Carolina.

Currently, over 2500 research projects are underway for 150 sponsors, the primary sponsors being the office of the Secretary of Defense and the Corps of Engineers (USACE). The following agencies were major sponsors of R&D at WES in FY 95: Defense Nuclear Agency, U.S. Army Environmental Center, U.S. Navy, U.S. Air Force, and the Environmental Protection Agency.

RESEARCH INTEREST OF THE RESEARCH LABORATORIES

The COASTAL AND HYDRAULICS LABORATORY was formed in FY 97 through the merger of two WES laboratories - the Hydraulics Laboratory (HL) and the Coastal Engineering Research Center (CERC). HL, formed in 1929, was the original "Waterways Experiment Station" while CERC was established by Public Law in 1963 as the direct successor to the Beach Erosion Board, which was created by Congress in 1930. The merger of these historically rich organizations has resulted in the formation of the largest water resources development research laboratory in the world with over 300 engineers, scientists and support personnel. CHL has nationally and internationally recognized engineering and scientific expertise related to inland waterways and the estuarine and coastal zones. CHL has world class capabilities in prototype data collection, experimental research and numerical modeling and simulation of processes involving water levels, current, winds, waves and tides, and their interaction with sediments and structures. Specific expertise lies in the engineering, hydrodynamics, sediment transport, dredging and dredged material disposal, physical processes associated with environmental analyses, groundwater modeling, military hydrology, harbor engineering, and riverbank and shore protection. CHL has the Tri-Service Reliance mission for Logistics-Over-the Shore (LOTS) for Sustainment Engineering. The Shore Protection Manual, which is internationally recognized as the "bible" of the coastal engineering profession, originally developed

by CERC, is being updated and expanded into the Coastal Engineering Manual by CHL.

The GEOTECHNICAL LABORATORY performs research, investigations, and testing in many areas, including: soil mechanics, structural foundation design, slope stability, seepage analysis, military pavements, rock mechanics, engineering geophysics, earthquake engineering, vehicle mobility, and trafficability. The laboratory is equipped to perform virtually any type of geotechnical testing needed to assist in these and other varied projects.

The STRUCTURES LABORATORY conducts scientific and engineering investigations and research and development projects in the fields of structural dynamics, survivability, weapons effects, earthquake engineering, earth dynamics, and construction materials. The projects include: design and analysis of structures to resist static and dynamic loading; defining effects produced by the detonation of explosives and the impact of high-velocity projectiles; development of useful applications of explosives; development of methods for fixed installation camouflage, concealment and deception; evaluation of properties, applications and behavior in service of construction materials, assemblages, and structures; and evaluation of the influence of natural and man-made material properties in the transmission of transient effects from explosions, impacts, and other energetic sources.

The ENVIRONMENTAL LABORATORY conducts research in all aspects of the interactions of human activities and natural events with the environment. Research areas include environmental aspects of dredging and dredged material disposal; water quality; hazardous waste site characterization, treatment and environmental restoration; environmental impact prediction, assessment, and remediation; natural and cultural resources management, stewardship, and conservation; coastal ecology; aquatic plant control; and wetlands.

The INFORMATION TECHNOLOGY LABORATORY performs research in computer-aided engineering, interdisciplinary engineering areas, computer science, high performance computing, instrumentation systems, and in all aspects of information technology. Projects include computer-aided structural engineering, application of computer-aided design and drafting (CADD) and geographic information system (GIS) technology, 3-D structural stability, finite element method analysis of structures, engineering reliability, soil-structure interaction, instrumentation systems design and development, relational database management, management information systems, information engineering, software engineering, groupware systems, information center concepts, telecommunications, scientific visualization (including virtual reality), office automation, graphic arts and publishing, library systems, and records management.

DEPARTMENT OF DEFENSE HIGH PERFORMANCE COMPUTING CENTER

The WES Information Technology Laboratory administers and operates on behalf of DoD a High Performance Computing (HPC) Center with a variety of advanced HPC systems which are configured to provide leading-edge computational performance, data storage capacity, network capabilities, and scientific visualization capabilities. A variety of languages and commercial software packages are available on these systems. The computational capabilities of the Center systems may, at the option of the Government, be made available to contractors. Proposals should include details on expected use of the DoD HPC Center systems.

SUMMARY

WES is a research and development complex with an international reputation. Some WES projects have world-wide significance while others are much smaller in scope. However, each project is in response to the special needs of the American people.

COASTAL AND HYDRAULICS LABORATORY

I. Introduction

Research is performed in the areas of hydraulic structures such as locks, dams, outlet works, control gates, stilling basins, spillways, channels, fish handling systems, and pumping stations, flood control channels; navigation channels; riverine and estuarine hydrodynamics and transport processes; groundwater; hydrology; dredging-related equipment; and on coastal problems related to shoreline protection; beach erosion; navigation; sedimentation; inlet stabilization; and construction, operation and maintenance of coastal structures (break-water, jetties, groins, seawalls, etc.). Major areas of interest include coastal hydrodynamics (wind waves, tides, currents, wind related water levels); coastal sedimentation (longshore transport, inlet sedimentation); coastal geology and geomorphology; design and stability of coastal structures; and interaction of structures and coastal processes. Other activities include descriptions of coastal processes; theoretical studies; numerical and physical model techniques; data collection and analysis techniques; development of laboratory and prototype instrumentation and equipment. The following sections contain information on these research areas and specific research thrusts.

II. Research Areas

A. Physical Processes in Estuaries (CHL-1)

1. The research program in estuarine physical processes deals with the hydrodynamic and transport characteristics of water bodies located between the sea and the upland limit of tidal effects. Research is directed toward knowledge that will improve field measurements and predictions of these processes.

2. Specific areas of required research include the following physical processes in estuaries and other tidal waters.

(a) The propagation of tides.

(b) Transport of salinity, mixing processes, stratified flows.

(c) Transport, erosion, and deposition of sediments, including settling velocity, aggregation of sediment, consolidation of sediment.

(d) Behavior and characteristics of sediment beds, including movement, consolidation, armoring, bonding, physical chemical characteristics, density, erodability.

(e) Flow between aquifers and surface waters.

3. Specific areas of required research include the following activities with respect to the physical processes listed.

(a) The effect of human activities, including dredging construction, vessel traffic, flow diversion, training, structures, and protective structures.

(b) Measurements of parameters that are indicative or descriptive of the processes listed in paragraph 2 by in-situ and remote methods in the lab and field.

(c) Prediction of processes listed in paragraph 2 by analytical means, physical models, numerical models, and other techniques.

(d) Conceptual and mathematical descriptions of the processes listed in paragraph 2.

(e) Development of materials, equipment, and methods that might lead to applied research that would make human activities listed safer, more economical, or more effective.
(Contact: Dr. Rob McAdory, 601-634-3057.)

B. Hydraulic Structures (CHL-2)

1. The research program in hydraulic structures deals with the hydraulic performance of locks, dams, outlet works, control gates, stilling basins, spillways, channels, bank protection, riprap stability, pumping plants and other hydraulic structures, and with physical and/or numerical model studies to predict and analyze the physical water quality aspects of water resources projects.

2. Specific areas of required research include the following:

(a) Physical and numerical hydraulic model investigations of a wide variety of hydraulic structures to verify proposed designs and develop more effective and economical designs.

(b) Analysis of model and prototype data and inspection of field installations to develop design criteria for hydraulic structures.

(c) Develop methods of correlating theoretical and experimental information with design methods used by the Corps of Engineers to improve existing procedures and provide material for inclusion in appropriate manuals.

(d) Develop physical and/or numerical models to predict and analyze the water quality aspects of water resources projects and

design appropriate hydraulic structures to control water as well as water quantity while satisfying the desired objectives.

(e) Conduct research and/or develop numerical codes to develop techniques for analyzing physical aspects of water quality in lakes and rivers through a better understanding of the hydrodynamics in density-stratified environments and for improving water quality within and downstream of density-stratified reservoirs and to investigate the ability of existing and proposed water resources projects to satisfy established water quality standards.

(f) Basic studies related to development of hydraulic design and operation guidance for hydraulic structures used in inland waterways for navigation and flood control purposes.

(g) Performance tests, both model and prototype, of hydraulic appurtenances to flood control and navigation dams such as spillways, outlet works, energy dissipators, and approach and exit channels, are conducted and/or analyzed to develop design guidance that will provide structures of maximum efficiency and reliability with minimum maintenance.

(h) Develop innovative methods to prepare and revise engineering manuals for hydraulic design of various hydraulic structures.

(i) Develop innovative methods to conduct training courses on design of various hydraulic structures.

(j) Develop innovative methods to prepare technical reports of all work conducted. (Contact: Dr. Phil Combs, 601-634-3344.)

C. Open Channel Flow and Sedimentation (CHL-3)

1. The Stable Flood Control Channel research project consists of basic studies related to development of hydraulic design guidance for designing modifications to natural stream channels to provide for local flood protection. Emphasis is placed on channel stability as well as channel flow capacity.

2. Specific areas of required research include the following:

(a) Studies related to the development of effective methods to analyze a natural stream's response to modifications made for flood control purposes.

(b) Studies applicable to development of streambank and streambed protection methods where channel instability exists.

(c) Studies applicable to development of sediment

transport, local scour, and stream form relationships for a broad range of stream types, bed and bank materials, and meteorological and hydrological conditions.

(d) Collection and analysis of data which aid in evaluating existing methods and/or developing new methods to analyze channel stability for the variety of channel flow conditions and stream types existing in natural stream systems. (Contact: Mr. Mike J. Trawle, 601-634-3518.)

D. Dredging Research (CHL-4)

1. The research program in dredging is directed towards reducing costs for performing dredging operations whether the dredging is performed by Corps of Engineers dredges or by Contractor dredges. The program includes evaluation of new and innovative equipment, improving the efficiency and scope of application of conventional equipment, and development of new equipment and techniques for performing difficult or costly dredging projects.

2. Specific areas of required or anticipated research include the following dredging areas.

(a) Instrumentation to monitor and control the dredging process.

(b) Equipment to detect the composition and character of bottom sediments, particularly the density structure of bottom strata.

(c) Equipment to quickly and efficiently perform pre- and post-dredging bottom surveys in the bins of hopper dredges.

(d) Equipment to monitor and measure the composition and quantity of dredged material in the bins of hopper dredges.

(e) Equipment to accurately position the dredge within the dredging project.

(f) Equipment that aids dredge inspectors in monitoring a dredging project by collecting and telemetering to a remote site pertinent information from the dredge.

(g) Equipment that detects the presence of rock or difficult-to-dredge materials within the limits of the dredging project.

(h) Equipment that increases the life of the dredge system such as abrasion-resistant discharge pipe.

(i) Equipment that minimizes environmental impact of the dredged such as suction devices that resuspend little or no sedi-

ments during the dredging cycle.

(j) Equipment for dredging contaminated sediments.

(k) Specialty dredging equipment.

(Contact: Mr. R. F. Athow, 601-634-2135.)

E. Navigation Channel Design (CHL-5)

1. The research program in navigation channel design involves basic research to develop design guidance for the design of new channels and modifications of existing waterways. It involves identifying maneuvering requirements in restricted waterways that affect the channel dimensions, alignment, and location of appurtenances in the navigation channel under various environmental and vessel traffic conditions. It also involves identifying the stability of the channel, maintenance requirements and designing structures that reduce or eliminate the maintenance requirements. Finally, it involves quantifying the flow and pressure fields generated by a tow or ship passing through a waterway and the related impacts on the sediment resuspension in the channel, channel border, and side channel/backwater areas. Studies involve deep and shallow draft navigation channels and physical and mathematical models. Human factors are included in research and project studies using a ship and tow simulator.

2. Specific areas of required research include the following:

(a) Physical model investigations of a wide variety of navigation channel configurations in many environments with different type vessels to verify proposed designs and to develop more efficient and safe designs and to lower environmental impacts.

(b) Development and enhancement of mathematical models of vessels, both ships and push-tows, for use on the simulator to add vessel types not available or to increase the accuracy with which the model reproduces the vessels response.

(c) Development of methods and modeling techniques to predict the currents and sediment transport characteristics of various channel designs and integrate this with the navigation model studies, including those generated by the vessel movement.

(d) Development of methods and modeling techniques to predict the currents and sediment transport characteristics of various channel designs and integrate this with the navigation model studies.

(e) Development of methods and techniques to prepare and display visual information for the pilot on the simulator projection system.

(f) Development of methods and measurement equipment, techniques for measuring scale model performance in physical model navigation studies.

(g) Development of methods and techniques for the analysis and evaluation of model results to optimize the channel design and to determine the level of safety, or conversely, risk involved with the various designs. (Contact: Dr. Larry L. Daggett, 601-634-2259.)

F. Computer-Aided Hydraulic Engineering (CHL-6)

1. The research program seeks to develop computer-aided design tools that can be used by hydraulic engineers in planning, design, construction, operation, and maintenance of navigation and flood control projects. The scope includes open channel and closed conduit flows, equipment, and structures. (Contact: Dr. Nolan Raphelt, 601-634-2634 and Mr. W. H. McAnally, 601-634-3822)

G. Groundwater (CHL-7)

1. The groundwater modeling research program is directed to the understanding and predicting, including the development of numerical codes, groundwater flows and contaminant transport in both the saturated and unsaturated zones for both porous and fractured media. The goal of the program is the development of modeling tools, including remedial alternative simulation, for optimal design and operation of the site cleanups. (Contact: Dr. Jeff P. Holland, 601-634-2644.)

H. Hydrology (CHL-8)

1. Research in this area is primarily directed at military applications as affect mobility, counter mobility and water supply.

2. Specific research is directed at the following areas:

(a) Remote sensing and quantification of precipitation.

(b) Development of spatially varying precipitation hydrology models.

(c) Visualization of results for hydrology and dam break models.

(d) Water location in arid and semi-arid regions.

(e) GIS interfacing with existing and new hydrology models.

(Contact: Dr. William D. Martin, 601-634-4157.)

I. H&H GIS/DATABASE DEVELOPMENT (CHL-9)

1. Research in this area is currently focused in the following areas:

(a) Electronic Navigation Charting

(b) Integration of GIS/Database and H&H models.

(c) Watershed management for erosion control

(d) Larger River System management for flood control navigation

(e) Visualization Techniques

(Contact: Dr. Nolan Raphelt, 601-634-2634.)

J. Hydrodynamics (CHL-10)

Research in shallow water wave estimation; forecasting and hindcasting of wind generated waves for oceanic to local regions; wave theory; statistical distribution of wave parameters; simulation of spectral conditions in wave basins; nearshore currents; wave breaking; wave/current interaction; long and short waves in ports and harbors; tsunami modeling; wind generated currents; storm surge; tidal circulation; two-and three-dimensional numerical simulation models (including finite difference, finite element, and curvilinear coordinate techniques); coastal meteorology; explosion generated waves; ship response to waves; moored ship response; and turbulence. (Contact: Mr. H. L. Butler, 601-634-2405.)

K. Coastal Processes, Coastal Inlets, and Navigation Channels (CHL-11)

Shoaling in inlets; stability of inlet channels; scour at structures; sediment transport modeling; numerical modeling of coastal regions; shoreline evolution modeling; storm erosion of beaches; wind and wave generated sediment transport; sediment budget analysis; wave forces/loads on gates (tainter, miter, etc.); and PC-, workstation-, and mainframe-based automated coastal engineering software (including relational and GIS data bases). (Contact: Mr. H. L. Butler, 601-634-2405.)

L. Coastal Structure and Facility Design (CHL-12)

Development of functional and stability design criteria for coastal structures and facilities (breakwaters, seawalls, jetties, groins, harbors, marinas, etc.); wave runup, over-topping, refraction, diffraction, transmission, reflection, etc.; design of floating breakwaters; breakwater stability; application of spectral wave conditions to coastal engineering; stability of riprap to

irregular wave attack; stability and functional design of over-topped rubble mound breakwaters; scale modeling of armor unit strength; analysis of structural data for floating breakwaters; investigation of numerical structural models for floating breakwaters; development of wave runup gage for rough and porous slopes; investigation of attenuation/mooring force models of floating breakwaters; development of materials and techniques to produce high quality break-water model armor units; analysis of wave runup overtopping, refraction, diffraction, transmission and/or reflection data on coastal structures and beaches and design of structures for Logistics-Over-The-Shore (LOTS) operations. (Contact: Mr. C. E. Chatham, Jr., 601-634-2460.)

M. Field and Laboratory Measurements, Data Collection, and Analysis (CHL-13)

Wave current, water level and wind measurement systems for laboratory and field cases; advanced data analysis (spectral and nonspectral) techniques; remote sensing techniques; bedload and suspended sediment transport; monitoring and evaluating technical and structural stability of coastal projects; field measurement of coastal processes; structural response instrumentation; bathymetric survey systems. (Contact: Mr. T. W. Richardson, 601-634-2019.)

N. Experimental Coastal Model Equipment, Operation and Analysis (CHL-14)

Development of equipment and techniques for specialized model construction, experimental wave generation equipment, specialized data acquisition and analysis systems, advanced model operations techniques, and laboratory and scale effects in movable bed model studies. (Contact: Mr. C. E. Chatham, Jr., 601-634-2460.)

O. General Coastal Engineering, Coastal Geology, and Dredging Investigations (CHL-15)

Sand bypassing systems and equipment; beachfill design; coastal geology and geomorphology; functional design and evaluation of coastal works and coastal structures; littoral transport; coastal and offshore dredging studies; agitation dredging systems and equipment; physical monitoring of dredged material; physical processes in coastal wetlands; application of Geographic Information Systems; design of nearshore and offshore dredged material placement; evaluation of dredged material disposal sites; analysis of dredging operations management. (Contact: Mr. T. W. Richardson, 601-634-2019.)

ENVIRONMENTAL LABORATORY

INTRODUCTION

The Environmental Laboratory (EL) conducts R&D for the Corps of Engineers, other Department of Defense elements, and other Government agencies in the general areas of Clean-up and Conservation. Clean-up deals with the development of technologies to improve site characterization, reduce the cost and time to remediate contaminated sites, and accurately assess and monitor the hazard associated with contamination. Areas of research include: (a) environmental sensing development, (b) hazardous waste site characterization and treatment, (c) sediment geochemistry and biological effects, and (d) water quality modeling.

Conservation deals with sustaining the natural and cultural resources entrusted to DoD for continued use through improving and developing tools and technologies which conserve, protect, and enhance natural and cultural resources and foster stewardship. Areas of research include: (a) environmental database development; (b) environmental impact prediction, assessment, and management; (c) environmental criteria for stream channel alteration; (d) natural resource management; (e) nonindigenous aquatic nuisance species management; (f) threatened and endangered species protection and management (g) water quality and ecological systems; (h) outdoor recreation; and (i) cultural resources.

CLEAN-UP

Environmental Sensing

I. Introduction

Current research is in the acquisition of information by remote sensor systems, the impact of the environment on imaging and other sensor systems, and advanced signal processing. Sensors using electromagnetic, seismic, and acoustic energy forms are of interest. In addition, work is conducted to determine terrain and other environmental effects on high-technology sensor systems. Sensor systems include optical and infrared millimeter wave (active and passive). Briefly described below are specific research areas.

II. Research Area

Sensing (EL-1)

This research includes the development of sensing, data processing and fusion, and display technologies for a variety of sensing applications. Emphasis is on concept development and

laboratory-scale tests (for data collection/concept demonstration purposes). Novel concepts for detection of surface and buried objects (metallic and nonmetallic) such as unexploded ordnance, as well as subsurface sensing of hazardous materials are among the objectives. Special areas of interest include radar and laser polarimetry, and hyperspectral imaging. Fundamental measurements and models that define the parameters controlling the propagation of electromagnetic, seismic, and acoustic energy through various soil types are also of interest. (Contact: Dr. Ernesto R. Cespedes, 601-634-2655.)

Hazardous Waste Site Characterization and Treatment

I. Introduction

An extensive research and development program is being conducted by the Department of Defense to assist in the cleanup of contamination at military installations. The U.S. Army Engineer Waterways Experiment Station is developing technologies for characterizing, monitoring, and applying physical, chemical and biological treatment of toxic and hazardous waste in contaminated surface and ground waters and soils. The WES is also developing, testing and verifying numerical models and guidance for solid waste disposal systems.

II. Research Areas

A. Innovative Technologies for Rapid Characterization and Monitoring of Hazardous Waste Sites (EL-2)

The WES, in coordination with the U.S. Army Environmental Center and other Tri-Service agencies, has developed the Site Characterization and Analysis Penetrometer System (SCAPS). The SCAPS is specially designed to conduct rapid site characterization/screening of installations for possible contamination. The SCAPS R&D Program is currently developing sensors for use with the cone penetrometer to detect contaminants such as petroleum, oil and lubricant products (for example, aviation fuels, diesel, gasoline), explosives compounds, volatile organic carbons (VOCs), heavy metals, and radionuclides. Additional areas of R&D include: advanced computational techniques for 3-D visualization of subsurface contamination; rapid data acquisition, analysis and interpretation; technologies to quantify levels of contamination; enhanced sampler technology development; contaminant monitor development for biological and chemical treatment assessment; and automated techniques for monitoring/assessing operational performance of remedial site cleanup operations. (Contact: Mr. John H. Ballard, 601-634-2446.)

B. Innovative Technologies for Treating Hazardous Waste and Contaminated Surface and Ground Waters (EL-3)

Presently, WES is continuing to conduct research, develop technologies and apply strategies to treat complex organic- and metal-contaminated hazardous liquids, off-gases, soils sludges, sediments, and residuals from past disposal practices. Research is divided into two major categories: technologies for treating contaminated soils and sediments, and innovative technologies for treating contaminated surface and ground waters. Areas of R&D include: (1) physical and chemical technologies to minimize or reduce the quantity and toxicity of hazardous waste, (2) biological processes and methods to detoxify/destroy hazardous waste constituents, (3) techniques for in situ treatment of groundwater aquifers, (4) laboratory design criteria for and field implementation of piloting equipment for promising technologies, and (5) computer-based techniques to assess operational performance of various treatment processes/systems. (Contacts: Mr. Mark Bricka (metals), 601-634-3700; Ms. Beth Fleming (physical-chemical organics), 601-634-3943 and Mr. Jeff Talley (bioremediation), 601-634-2856.)

C. Design, Evaluation, Verification and Modeling of Solid and Hazardous Wastes and Contaminated Sediments (EL-4)

Presently, WES is continuing to develop water balance and leachate models for solid waste disposal systems and dredged material disposal facilities. Additional work is needed to model innovative designs, nonsoil surface materials, cobbled surfaces, preferential flow through heterogeneous waste materials and other layers, and effects of complex mixtures of vegetation including trees. Similarly, additional work is needed to verify the existing models. (Contact: Dr. Paul R. Schroeder, 601-634-3709.)

Sediment Geochemistry and Biological Effects

I. Introduction

Potential adverse environmental impacts of disposal of contaminated sediments must be assessed prior to permitting operations. This includes the determination of the impacts that contaminated dredged materials exert on the environment prior to dredging.

II. Research Areas

A. Environmental Risk Assessment (EL-5)

Current research on the fate and effects of environmental contaminants occurs under the general paradigm of Environmental Risk Assessment. Specific studies fall into one or more of the following areas. (Contact: Dr. David Moore, 601-634-2910.)

(1) Hazard Identification. This is the process of showing causality. That is, can a chemical or complex mixture cause some adverse effect. If this causality can be demonstrated, the chemical is referred to as a "hazard." If there is no causal link, risk need not be quantified. Important target receptors are also identified by this stage (for example, humans, endangered species, ecologically or economically important species). Research is conducted to develop the tools for hazard identification and the establishment of causality.

(2) Effects Assessment. While Hazard Identification decides if a chemical or complex mixture is toxic, Effects Assessment determines the magnitude of the toxic response. This is accomplished via experimental research in which surrogate species are exposed to gradients (spatial, concentration, etc.) of the hazard in question, and biological effects are monitored over time. Biologically important endpoints measured include survival, growth, reproduction and population-level parameters. These endpoints must be accompanied by technically sound interpretive guidance. Results are expressed in dose-response or exposure-response relationships. Research is carried out to develop the necessary experimental/ statistical designs, technically sound tests (for example, chronic sublethal sediment bioassays) and appropriate extrapolations (for example, high dose to low environmentally realistic exposures, surrogate test species to receptor of interest). Analysis of the uncertainty associated with these effects assessments is also carried out.

(3) Exposure Assessment. In Exposure Assessment, the magnitude, frequency and duration of contaminant exposure relative to the target receptor(s) are determined. This research is model-intensive, with both descriptive and quantitative models being used to evaluate pathways and routes. A pathway is where the hazard travels between the initial source of contamination and the ultimate biological receptor. A route is how the chemical enters the receptor (for example, ingestion, inhalation, dermal absorption, bioaccumulation, trophic transfer). Analysis of the uncertainty associated with these exposure assessments is also carried out.

(4) Risk Characterization, Management, Communication, and Analysis. Outputs from the Effects Assessment and Exposure Assessment are joined in Risk Characterization to yield an estimate of risk. Research is conducted to determine the best ways to characterize risk both numerically and descriptively. Also, uncertainty analysis is undertaken to identify the qualitatively and quantitative important sources of uncertainty. Techniques employed include error propagation, probability distributions, sensitivity analysis, Monte Carlo simulation and others.

Once environmental risk has been quantified, action may be required to manage it. Research is conducted to develop management

alternatives which range from no action to extensive (and expensive) remediation. Results of the Environmental Risk Assessment are weighed and balanced with other factors such as applicable laws and regulations, engineering feasibility, potential benefits, costs, economic impacts, and the socio-political decision environment. Risk Communication is a dialogue, not a monologue. It occurs at two levels: between the risk assessor and the risk manager, and between the risk manager and the public. Research is conducted to identify optimal procedures for communicating environmental risks, including an appreciation for the limits and uncertainties of the numerical results. Risk Analysis is a broad, inclusive term encompassing the processes of Risk Assessment, Risk Management, and Risk Communication as well as any field verification or monitoring activities. Field verification is a study or studies carried out to determine the accuracy of laboratory observations and predictions. Field monitoring (in the context of Risk Assessment) is undertaken to ensure that steps taken to manage the chemical risks were successful. Field research studies are carried out for both verification and monitoring purposes.

B. Sediment Water Interactions (EL-6)

Current research encompasses a wide range of investigations designed to increase understanding of sediment-water interactions. Emphasis is on conduct of investigations for determining the impacts that sediment/soil properties have on sorption and transformation of explosives and release of semi-volatile contaminants to the atmosphere. Factors responsible for sorption and transformation of explosives include redox potential, pH, and the geochemical characteristics of the soil or sediment. Factors affecting the release of semi-volatile contaminants from soil or sediment to the atmosphere include relative humidity, wind speed, contaminant concentration, moisture content, porosity, and organic carbon content. Research is also conducted on collodial system contaminant transport, accelerated sediment oxidation, and the role of solution chemistry in contaminant partitioning between sediment and water. (Contact: Dr. J. M. Brannon, 601-634-3725.)

Biodegradation of Contaminants: Studies in the biodegradation area emphasize destruction of organic contaminants for remediation purposes. Emphasis is on (1) delineating biodegrative pathways; (2) determining intermediate and final products and by-products; (3) assessing the role of environmental factors in regulating the pathways utilized and the rate and extent of destruction of the parent compound; (4) determining the survival and activity of microorganisms added to soils, sediments, and biotreatment systems; and (5) enhancing biodegradation to obtain the maximum destruction of organic contaminants within a soil, sediment, or treatment system. (Contacts: Dr. Herb Fredrickson, 601/634-3716; and Dr. Douglas Gunnison, 601/634-3873.)

C. Techniques for Contaminated Dredged Material Disposal and Treatment (EL-7)

Specific areas of required or anticipated research include the following:

(1) Application of innovative techniques, equipment, and control measures for dredging, transport, and placement of contaminated sediments. (Contact: Mr. Daniel E. Averett, 601-634-3959.)

(2) Development of cost-efficient technologies for control-treatment of contaminated dredged material, including assessment of physical/chemical processing technologies for application to contaminated dredged material slurries, supernatant, and leachate; techniques for evaluating the processing technologies; methods for site evaluation; and techniques for evaluating cost-effectiveness. (Contact: Mr. Tommy E. Myers, 601-634-3939.)

(3) Development or enhancement of computer models to be included in the ADDAMS to evaluate the environmental impacts of dredged material disposal. Evaluations include water quality impacts of initial release in open water, effluent discharge, runoff and leachate, benthic impacts, plant and animal uptake, and volatilization. (Contact: Dr. Paul R. Schroeder, 601-634-3709.)

Water Quality Modeling

I. Introduction

The Corps of Engineers is involved in research to develop water quality models for riverine, reservoir, wetland, coastal, and marine surface and groundwater. Current research encompasses a wide range of environmental issues. Emphasis is on short- and long-term field and laboratory investigations to improve the techniques for evaluating water quality and developing water quality management guidelines.

II. Research Area

Numerical Water Quality and Contaminant Modeling (EL-8)

This area of work is oriented toward development and application of water quality models for watersheds and receiving waters (riverine, reservoir, wetland, estuarine and coastal) and ground-water. Emphasis is on formulation of the appropriate chemical and biological algorithms for simulating water quality. Areas of need also include: collection and assemblage of water quality data for model evaluation; development or improvement of interactive bed sediment/water column algorithms; review, development, and appli-cation of toxicant transport development of models for runoff quality; and fate models; development of models for evaluating groundwater remediation involving multiphase, multicomponent

contaminant transport; development of special numerical solution schemes; and development of software to enhance model utility and ease of application. (Contact: Dr. Mark Dortch, 601-634-3517.)

CONSERVATION

Environmental Database Development

I. Introduction

Engineers, scientists and managers require well-organized, easily accessible environmental databases to make sound conservation and stewardship decisions. Research in this area deals with techniques to effectively characterize, quantify and analyze the spatial and temporal components of the environment at various resolutions.

II. Research Areas

A. Geospatial Environmental Database Development (EL-9)

This research area is concerned with techniques for developing holistic, geographically referenced environmental databases at a wide range of spatial and temporal resolutions. Holistic environmental databases integrate quantitative characterizations of the hydrosphere, biosphere, geosphere, and atmosphere. Spatial resolutions range from the characterization of regional watersheds to the characterization of the internal canopy conditions for individual trees. Temporal resolutions range from decades to minutes. The research includes investigations onsite and remote techniques for characterizing and monitoring single environmental factors such as vegetation height, density and biomass; soil moisture content; and water quality parameters. The research includes investigations on techniques for collecting, quantifying, integrating, storing and accessing geospatial and statistical data. (Contacts: Mr. Wade West, 601-634-2232, and Dr. Rose Kress, 601-634-3665.)

B. Geospatial Data Analysis Techniques (EL-10)

This research area is concerned with developing methods to include the spatial and temporal properties of environmental factors in all aspects of environmental stewardship. It includes development of geospatial statistical measures and quantitative indices for use in numerical modeling, impact assessment, risk assessment and management trade-off analysis. It includes techniques for quantitative regional characterization of the natural resource base. The research investigates methods for modeling spatial patterns of environmental conditions over time. (Contacts: Mr. Wade West, 601-634-2232, and Dr. Rose Kress, 601-634-3665.)

Environmental Impact Prediction, Assessment, and Management

I. Introduction

The program of research on environmental impact prediction, assessment, and remediation is intended to provide Corps, Army, and other field operating elements with techniques and methodologies for environmental assessments and EIS preparation, guidance on selecting appropriate planning, design, construction, and operation alternatives, and implementation of the planning function pursuant to NEPA and other legislation and guidance. Specific objectives include:

(a) Developing, verifying, and demonstrating practical prediction and assessment techniques including applying and refining habitat-based evaluation methods, evaluating mitigation measures, developing streamlined frameworks for environmental monitoring, applying ecosystem simulation principles to environmental analysis, and estimating future habitat quality.

(b) Documenting and quantifying environmental effects associated with various types of Corps, Army, and other activities. Research in this category has included the effects of aquatic habitat modification on anadromous fishes, the effects of selective clearing and snagging on instream habitat, and the benefits of channel modification for aquatic habitat in reservoir tailwaters and local flood control channels.

(c) Developing and demonstrating design, construction, and management alternatives that will minimize adverse effects and protect natural and cultural resources. Research in this category has included techniques for managing wildlife habitats, preserving archeological sites, and stabilizing eroding shorelines.

(d) Developing design and operational techniques to control potential adverse environmental effects of dredging and dredged material disposal operations. Included in these efforts are resuspension and release of contaminants by dredging, long-term sizing of disposal facilities, subaqueous disposal, capping, and dewatering. Many of the procedures developed from these research efforts are being programmed as computer models under the framework of a family of programs called the Automated Dredging and Disposal Alternatives Management System (ADDAMS) for use on personal computers.

II. Research Areas

A. Biotechnical Shore Stabilization (EL-11)

Biotechnical (sometimes called bioengineering) shore stabilization is the use of a combination of live vegetation and

structural materials (for example, breakwaters, geotextiles, erosion control fabrics/mats, building materials) for erosion control of shores. Shores of particular interest are those of streams, lakes, or dredged material deposits and subject to erosion from waves, surface runoff, and wind. Research is needed to determine the causes and amounts of erosion and to identify and assess cost-effective biotechnical erosion control methods. Studies may include, but are not limited to, identifying, developing, and cultivating appropriate flood-tolerant plants and varieties or cultivars and cost-effective installation procedures of biotechnical techniques. (Contact: Mr. Hollis H. Allen, 601-634-3845).

B. Fishery Investigations (EL-12)

This area of work is concerned with the development and application of methods for fish population and habitat assessment. Ongoing research covers a range of topics concerned with fish resource inventory, migration and movement, age and growth, reproduction, and aquatic habitat classification and assessment. Proposals in all fish resource areas are invited, particularly those concerned with the development or application of improved fish sampling and analysis methods using recent technological advancements. (Contact: Mr. K. Jack Killgore, 601-634-3397.)

C. Macroinvertebrate Investigations (EL-13)

This area of work is concerned with the development and application of methods for assessing the environmental effects of Corps of Engineers activities by analysis of macroinvertebrate populations and communities. Studies involve laboratory evaluation of behavior and physical condition, or field studies that involve secondary production or the determination of selected biotic indices (such as species richness, diversity, evenness, relative species abundance, etc.) of naturally occurring mollusc, chironomid, or oligochaete communities. (Contact: Dr. Andrew C. Miller, 601-634-2141.)

D. Mitigation (EL-14)

An avoidance, minimization, and/or compensation process is required for impacts from water resources projects on ecological resources (fish, wildlife, habitat, or installation activities). Planning and implementing mitigation is a complex process, and new ideas that contribute to success of mitigation are welcome. Subjects such as Best Management Practices for avoiding or minimizing impacts, planning for mitigation based on impact analysis, incremental analysis to justify mitigation, mitigation banking, future predictions, and mitigation for indirect or cumulative impacts are included in this area. (Contact: Dr. Jean O'Neil, 601-634-3641.)

E. Instream Flow Requirements for Aquatic Biota (EL-15)

This area of work is oriented toward development and application of fish habitat assessment methods. Currently, the most widely used system, the Physical Habitat Simulation System (PHABSIM), is being used to assess the effects of reservoir operations on downstream fish habitat. Research is needed to better quantify the relationships for fish preference and flow conditions, as well as habitat requirements for aquatic invertebrates. Verification studies of these models will be required as development continues. The assessment method must be able to evaluate the impacts of a variety of reservoir operations such as base load or peaking hydropower releases. (Contact: Dr. John Nestler, 601-634-3870.)

F. Behavioral and Structural Fish Barriers (EL-16)

Entrainment of fish at Corps hydropower projects may result in passage of fish through turbines with attendant death or injury from impact with runner blades, pressure changes, or shear forces. Evaluations of a number of behaviorally based technologies and structural barrier designs conducted under laboratory and field conditions have yielded results that are generally inconsistent. Consequently, there currently exists no consistent guidelines for selection of appropriate technology for site-specific applications at Corps dams. Research is required to relate effectiveness of different technologies to size and species of fish, dam design, operations, season, and other site-specific conditions.The information produced by this research will be used to develop specifications and guidelines for fish protection technologies at Corps dams to reduce entrainment and mortality. This work may involve literature synthesis, laboratory work, design and fabrication of prototype systems, or field studies. (Contact: Dr. John Nestler, 601-634-3870.)

G. Fish Guidance and Bypass Systems (EL-17)

CE water resource activities may result in blockage of historical fish migration routes through waterways. These blockages, with associated fragmentation of habitats, may have severe impacts on anadromous and catadromous fish populations. A variety of bypass system technologies are available to guide fish around dams. However, many of these systems operate at reduced efficiencies because they damage fish, fish are unable to locate entrances to the systems, or because fish become disoriented and "fall back" after an initial successful passage. Research is required to better understand the hydraulic and behavioral characteristics of fish bypass systems, including the use of behavioral technologies to guide fishes towards these systems and to successfully orient them within the system. (Contact: Dr. John M. Nestler, 601/634-3870.)

H. Coastal Ecology (EL-18)

Coastal ecology research at the U.S. Army Engineer Waterways Experiment Station is concerned with the effects of engineering activities on coastal environment. This involves research on the effects of dredging, dredged material disposal, and coastal construction (for example, jetties and breakwaters) on fish, marine reptile, marine mammal, shorebird, and shellfish population dynamics, hard and soft bottom benthic resources, and coastal marshes. It also involves research on fish, marine reptile, marine mammal, shorebird, and shellfish management under natural and/or controlled environmental conditions. This may include literature synthesis, field studies and modeling. (Contact: Dr. Paul Becker, 601-634-4261.)

I. Techniques for Designing, Operating and Managing Dredged Material Disposal Facilities and Beneficial Use Projects (EL-19)

(1) Refinement and verification of techniques for designing, operating, and managing dredged material disposal areas.

(2) Development of a computerized economic database for costs associated with dredging sediments; disposing of dredged material; and constructing, rehabilitating, and operating and managing dredged material disposal areas.

(3) Development and refinement of computer models for dredged material management and beneficial use to be included in the ADDAMS. (Contact: Dr. Paul R. Schroeder, 601-634-3709.)

Environmental Criteria for Stream Channel Alteration Projects

I. Introduction

The Corps of Engineers is involved in alteration of stream channels for flood control, navigation, channel stabilization, and stream relocation. Modifications to channels include removal of snags and vegetation, channel alignment (straightening), channel enlargement, construction of levees, streambank protection, and grade control. The Corps is also involved in regulating and furnishing technical assistance to States in regard to other types of channel alterations such as gravel mining. Work at the Waterways Experiment Station and elsewhere has generated environmental design criteria for stream channel alterations to improve the net effect of these projects. Examples of environmental design features include low-flow channels, combinations of structure and vegetation, management of cutoff bendways and other backwater areas, and recreational trails.

II. Research Areas

A. Impacts of Riparian and Instream Vegetation (EL-20)

Current research is directed toward formulating guidelines for the inclusion of vegetation in stream restoration and flood control projects. Among the general issues addressed are; instream and riparian habitat assessment; impacts of vegetation on flow conveyance, channel stability, and sediment transport; and monitoring and maintenance of woody vegetation in floodways. Proposals are invited in these general areas and related efforts. In addition, specific needs include the following: (1) Techniques to quantify habitat and other environmental benefits of riparian vegetation, (2) Algorithms that account for momentum losses at vegetated floodplain/channel interfaces, (3) Data supporting evaluations of the hydraulic impacts of vegetation, (4) Case studies of monitoring and maintenance plans applied to vegetated floodways, and (5) Development and refinement of related computerized databases and models. (Contact: Dr. J. Craig Fischenich, 601-634-3449.)

B. Assessing Benefits of Channel Modifications (EL-21)

Dams and local flood control structures may degrade aquatic habitat conditions in tailwaters and streams. In some cases, habitat degradation can be eliminated, stabilized or reversed through channel modification for aquatic habitat (for example, construction of low-cost, low-head weirs to create pools) with minimal changes in dam operation or flood channel design. However, there are no widely accepted methods available to incrementally relate instream aquatic habitat value, channel modifications, and instream flows to allow trade-off analysis between cost, design, and habitat benefits. This work will modify existing instream flow methods or develop new methods that will allow incremental assessment of habitat values, alternative flows, and different channel designs. This work may involve data collection, analysis, interpretation, and software development. (Contact: Dr. John Nestler, 601-634-3870.)

Natural Resource Management

I. Introduction

As a part of its mission responsibilities, the Corps of Engineers must maintain and manage millions of acres of land, much of it surrounding over 700 water resource development projects throughout the United States. This includes fish and wildlife habitat sites, specific communities such as riparian zones and wetlands, and recreation sites. Technology needed for managing and enhancing these facilities includes research areas that involve endangered species, waterfowl, riparian zone management, range and turfgrass management, insect pest management, and the general stewardship of these natural resources. Developed technology is provided to Corps Civil Works projects as well as military instal-

lations and other cooperating Federal agencies.

II. Research Areas

A. Natural Resources Stewardship (EL-22)

(1) Integrated Natural Resources Management. This area of work is oriented toward biological diversity, holistic ecology, and the stewardship and management of habitat-related natural resources at Corps water resource projects and military installations. Emphasis is on integrated natural resources management, which includes the analysis of human-related activities on biological resources and the effects of biological resources on other resources. Current research is being conducted on integrated ecosystem management, analysis of impacts to natural landscapes and their components, habitat delineation and analysis, and program development for natural resources management. Related components to complete stewardship include management of information and databases. The work involves literature synthesis, field studies, data analysis, and report preparation. (Contacts: Mr. Hollis H. Allen, 601-634-3845, and Mr. Michael R. Waring, 601-634-2290.)

(2) Riparian Zone Management. This area of research involves studies on riparian habitat assessment, restoration, and management for natural resources stewardship on Civil Works lands and Department of Defense military installations. Emphasis is on the development of methods and technical guidelines appropriate for managing riparian zones and associated habitats on multiple-use lands. This also includes research on transition areas between riparian areas and other systems. This work would include literature searches, field investigations, restoration projects, data analysis, and development of reports and management action plans. Priorities will depend on regional needs, as determined by study sponsors (that is, Corps districts/sponsors and military installations). (Contact: Mr. Chester O. Martin, 601-634-3958.)

(3) Tools for Natural and Cultural Resources at Multiple Scales. Management of resources in today's climate requires an awareness of scale and context of those resources. Issues ranging from genetic diversity to watershed or landscape planning are relevant to management decisions. Planners, regulators, and land managers must be able to use existing tools (decision-support systems, models, databases, procedures, etc.) and to adapt new tools to their needs. Although the general processes of resource inventory, impact assessment, and management or mitigation will remain applicable, those activities may be conducted in a different context or at more scales than before. Work under this announcement would supply tools for natural and cultural resources management in an ecosystem or holistic context. (Contact: Dr. L. Jean O'Neil, 601-634-3641.)

B. Wildlife Resource Management (EL-23)

The U.S. Army Engineer Waterways Experiment Station is developing user information for Department of Defense (DoD) personnel involved in the administration, planning, and operation of wildlife management programs and activities. The emphasis of the work is to provide technology transfer on biologically sound, technically reliable, and cost-effective wildlife-related management strategies appropriate for Civil Works projects and DoD installations. The major product for the work is the "U.S. Army Corps of Engineers Wildlife Resources Management Manual." Reports for the manual are arranged in nine chapters. Reports are currently needed on wildlife species, management techniques, and plant materials. Reports are primarily extensive literature reviews on a particular subject, which results in the presentation of appropriate information in a comprehensive and readable style; the basic format is established in the reports completed to date. Proposals should identify a specific section (or sections) to be prepared and should include an outline and description of topics to be developed for the report. Other tasks in this work area include habitat assessments, population surveys, and development of management plans. (Contact: Mr. Chester O. Martin, 601-634-3958.)

C. Endangered Species (EL-24)

This area of work involves studies of endangered and threatened species on Department of Defense and other Federal agency lands. Tasks would include site-specific surveys, habitat analysis, and development of management plans for species of concern. Individual studies would involve literature searches and synthesis of information, field investigations, data analysis, coordination with Federal and state agencies and conservation organizations, and preparation of endangered species survey reports and management guidelines. Management recommendations will be specific to the region of study. Species of concern will vary, depending on requests from Civil Works projects and military installations. (Contacts: Mr. Chester O. Martin, 601-634-3958, and Mr. Michael R. Waring, 601-634-2290.)

D. Waterfowl Resources (EL-25)

This research area includes studies on waterfowl biology and habitat management on Civil Works projects and Department of Defense military installations. Emphasis is on waterfowl habitat assessment, population surveys, and development of stewardship and management plans for various waterfowl habitat management programs. Current studies involve developing management plans for various habitat management practices such as moist-soil systems, greentree subimpoundments, and created ponds. The work would include literature reviews, field investigations, data analysis, development of techniques and management guidelines, and preparation of technical reports. (Contact: Dr. K. C. Jensen, 601-634-3047.)

E. Wetlands (EL-26)

Wetlands research, especially as it pertains to wetlands restoration and development, has been occurring as an ongoing activity of the Corps of Engineers for the past two decades, primarily as a secondary or minor objective of navigation or flood control objectives. WES has been at the forefront in developing the technology that allowed this important wetlands work to take place, has developed a number of these wetlands, and has developed long-term monitoring methodologies to document the progress and ecological succession of these wetlands. In addition, WES has developed methodologies for delineating and evaluating wetlands on a national basis that has become the mandatory wetlands regulatory framework for Federal agencies. This work is expected to continue as part of a series of wetlands task areas. Research task areas outlined below will be conducted both in-house at WES, with other agencies, or will be contracted. Studies must be short term due to funding and time constraints, and must address one or more of the research tasks. (Contact: Dr. Russell F. Theriot, 601-634-2733.)

(1) Critical Processes of Wetlands. To examine the basic physical, chemical, and biological processes that cause wetlands to provide important functions, and to relate those processes and functions to other aspects of wetlands work in the Corps of Engineers. (Contact: Mr. Ellis Clairain, 601-634-3774.)

(2) Wetlands Delineation and Evaluation. Objectives of this task area are to examine technical assumptions in the 1987 "Corps of Engineers Wetland Delineation Manual" and to develop techniques to assess wetland functions and values. The first objective will be accomplished through a combination of field and laboratory studies to examine hydrology/vegetation/soil relationships, morphological development of hydric soils, and physiological response of vegetation to soil saturation in relation to the growing season. Results from these studies will be provided to the Federal Interagency Committee responsible for developing future wetland delineation manuals. The second objective will also be accomplished through field and laboratory studies. Efforts will focus on model development employing the Hydrogeomorphic Approach to Assessment of Wetland Functions (HGM) and implementation of basic research to test assumption in the HGM models. Both national and regional models will be developed using regional experts and published literature. HGM models will be field tested and assumptions examined using field studies to ascertain physical, chemical, and biotic wetland characteristics associated with different wetland functions and wetland types. (Contact: Mr. Ellis Clairain, 601-634-3774.)

(3) Wetlands Restoration, Protection and Creation. To study existing wetlands restoration, protection and creation sites built from dredged material, for compensatory mitigation, and for other non-regulatory purposes such as shoreline stabilization and erosion

control. To test wetlands techniques and further refine those techniques to be applicable for the broad range of wetlands projects encompassed within Corps of Engineers activities, including addressing erosion and subsidence on a large scale. To test guidelines for wetlands restoration, protection and creation that can be used for mitigation, O&M, general construction, and other Corps of Engineers projects, and that will also find use by permit applicants as they mitigate for lost wetlands. To test and verify the Corps wetlands engineering and design criteria handbooks. (Contact: Dr. Mary Landin, [e-mail landinm@ex1.wes.army.mil] 601-634-2942.)

Nonindigenous Aquatic Nuisance Species Management

I. Introduction

In a 1993 report, the U.S. Congress, Office of Technology Assessment estimated that non-indigenous pest species have resulted in US losses of millions to perhaps billions of dollars annually. They reported documented losses of $97 billion between 1906-1991. When environmental conditions are favorable, non-indigenous species, such as hydrilla (*Hydrilla verticillata*) and the zebra mussel (*Dreissena polymorpha*), become established and disrupt the aquatic environment and economy of infested areas.

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (Public Law 101-646) and the River Harbor Act of 1958; (Public Law 85-500) as amended, direct the Corps of Engineers to develop environmentally sound control methods to prevent, monitor, and control introductions of non-indigenous aquatic nuisance species.

II. Research Areas

A. Aquatic Plant Control (EL-27)

Aquatic plant research for the management of non-indigenous aquatic plant species in navigable waters, tributary streams, connecting channels, and other allied waters is a continuing activity of the Corps of Engineers. The thrust of this research is to reduce non-indigenous plant populations to non-problem levels, enhancing and/or replacing these non-indigenous species with indigenous species as more beneficial and productive aquatic habitat. Currently, research is focused on developing effective economical, and environmentally compatible technologies for managing two emerging problem aquatic plants, hydrilla and Eurasian watermilfoil. Areas of technology development include advanced management strategies and applications, techniques for establishing desirable aquatic vegetation, and computer-based systems for aquatic plant management planning. (Contact: Dr. John Barko, 601-634-3654.)

(1) Aquatic Plant Control Simulation Models. Personal computer-based software packages are being developed to model/simulate the interactions among nuisance aquatic plants and control techniques implemented for their management. The work includes development of plant growth models for four exotic aquatic plant species; biological control simulation models (models include growth, development and interaction modules) for selected insects and fish released for control of nuisance aquatic plant species; and chemical control simulation models (models include herbicide fate and effects modules) for commonly used herbicides labeled for aquatic application. Environmental databases are being compiled in a digital format compatible with the models to allow simulations to be generated for site-specific conditions. (Contact: Dr. John Madsen, 214-436-2215.)

(2) Techniques for Assessing Aquatic Plant-Infested Environments. Current techniques for quantitatively sampling and mapping aquatic plant-infested environments are highly labor intensive and only provide a low-resolution picture of environments that exhibit a high degree of spatial variability. High-resolution automated and semi-automated techniques are needed. Work in this research area has focused on remote sensing techniques such as use of airborne scanners and state-of-the-art hydroacoustic equipment. Future research will focus on developing theoretically feasible measurement systems into devices which may be employed by operational aquatic plant managers. (Contacts: Mr. M. R. Graves, 601-634-2557, and Mr. Bruce M. Sabol, 601-634-2297.)

(3) Biological Control Methods for Aquatic Plants. Current research deals with biological control of problem aquatic macrophytes using microorganisms, aquatic invertebrates and vertebrates. The objective of this work is to develop an operational capability for the use of biological agents to control aquatic plants. Research topics of interest include specificity and ecology of microflora of aquatic macrophytes, stimulants and attractants of invertebrates impacting aquatic macrophytes, and revegetation with desirable aquatic plants for the inhibition or prevention of problem plant species. (Contact: Dr. Alfred F. Cofrancesco, 601-634-3182.)

(4) Chemical Control Methods for Aquatic Plants. A need exists for development of aquatic plant management methods which utilize both herbicides and plant growth regulators to control or maintain plant populations below nuisance levels. Research is needed on the physiological weak points in the growth cycle of nuisance aquatic plants for application of control measures, herbicide delivery systems (water-dispersible granules, emulsifiable concentrations, flowable suspensions, etc.) to deliver the active ingredient to the target plant, and field evaluations of the effects of aquatic herbicides and plant growth regulators on nuisance species. Evaluation of the effects of chemical control on plant growth, flowering/seed production and reproductive structures is also

needed. (Contact: Dr. Kurt Getsinger, 601-634-2498.)

(5) Competition and Aquatic Plant Succession. The creation of new submersed aquatic plant habitats by reservoir and waterway construction provides an ideal environment for the establishment of weedy submersed plants. These species are well adapted for colonizing new and/or disturbed substrates. Given time, ecological succession may lead to the development of more desirable plant communities composed of native vegetation. However, man-induced disturbances to the system maintain the aquatic environment in an ecologically immature state, favoring reestablishment of problematic weedy species. Proposals should examine methods for altering the species composition of submersed aquatic plant communities to minimize the growth of weedy species and encourage the growth of more desirable nonproblem vegetation. (Contact: Dr. R. Michael Smart, 214-436-2215.)

(6) Relationships Between Fish and Aquatic Plants. Aquatic plant control methods are developed to be environmentally compatible, regardless of the situation and/or the control method being implemented. Aquatic plants, though problems to water uses, provide habitat for fisheries and organisms that support fish populations. Currently, there is insufficient data for developing the relationships between fish and aquatic plants that are needed to dictate the degree of control of the plants without destroying the habitat, thus ensuring compatibility. (Contact: Dr. Jack Killgore, 601-634-3397.)

B. Zebra Mussel Control (EL-28)

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 specified that the Assistant Secretary of the Army, Civil Works, will develop a program of research, technology development, and demonstration for the environmentally sound control of zebra mussels in and around public facilities.

Control strategies suitable for use in large waterways will be based primarily on physical rather than chemical methods to ensure that native biota and potable water supplies will not be negatively affected. Ongoing and planned studies consist of the following: analysis of the biology and physiology of zebra mussels; investigation of physical condition, habitat requirements, and size demography of naturally occurring populations of zebra mussels; and evaluation of the tolerance of zebra mussels to desiccation, elevated temperatures, and anoxia and other controls. In addition to biological studies, considerable effort will be devoted to modifying existing operation, maintenance or design features of structural components of the facility. This work is directed toward all public facilities along waterways and includes water intake plants, navigation locks, gated dams, outlet works, pumping plants, and drainage structures. (Contact: Dr. Ed Theriot, 601-

634-2678.)

Water Quality and Ecological Systems

I. Introduction

The Corps of Engineers is involved in research to develop water quality and ecological system models for riverine, reservoir, wetland, coastal and marine surface and groundwater. Current research encompasses a wide range of environmental issues. Emphasis is on short- and long-term field and laboratory investigations to improve the techniques for evaluating water quality and developing water quality management guidelines. The research also emphasizes the development of biological models for terrestrial, lacustrine, palustrine, estuarine and coastal environments to assist in evaluating potential effects of natural and man-made alterations.

II. Research Areas

A. Limnological Investigations and Water Quality Management (EL-29)

Current research encompasses a wide range of investigations designed to increase the Corps' understanding of important limnological processes influencing tailwater, reservoir, wetland and coastal quality. Emphasis is on the conduct of both short- and long-term field and laboratory investigations, the development of improved techniques for evaluating water quality conditions, formulation of sample design methodologies, and development of improved water quality management guidelines. Research is also conducted in the area of simplified techniques for the description and prediction of water quality conditions and problems. Integrated methods for water quality management are developed and evaluated. Proposals for research categories are invited. (Contact: Dr. Robert Kennedy, 601-634-3659.)

B. Ecological Modeling (EL-30)

Research into the development and application of a variety of biological models for terrestrial, lacustrine, palustrine, estuarine, and coastal habitats. This research involves the use of traditional population and community dynamics models as well as spatially explicit, structured-population and individual oriented models for addressing a wide variety of biological problems. Research is also ongoing for the integration of models spanning different spatial and temporal scales into graphical-based simulation models. The integrated models can be utilized to analyze interrelations and dependence across trophic levels and to determine the potential effects of alterations (natural and man-made perturbations) to the ecological system. (Contact: Dr. Pace Wilber, 601-634-4258.)

Outdoor Recreation

I. Introduction

Research and development is conducted at the U.S. Army Engineer Waterways Experiment Station in support of outdoor recreation planning and management at 463 multipurpose reservoirs located in 43 states. These projects include 11.5 million acres of land and adjacent water and a total shoreline length over triple the coastline of the continental United States. The Corps of Engineers is

the largest supplier of water-oriented outdoor recreation opportunities in the nation.

All aspects of public use of multi-purpose water resource development projects are considered in recreation research and development. The trend is, where feasible, to develop automated tools for use by the planner and manager in the interest of efficiency of operation. This objective is considered in the context of providing high quality recreation experiences for the visitors to these lakes in a safe and pleasant atmosphere. Some current examples of research thrust in this area follow.

II. Research Areas

A. Carrying Capacity (EL-31)

Ongoing research and technical support is currently concentrated on physical and social carrying capacity of lake water surface. Shoreline management aspects of this work addresses commercial marina development, public access for boating and related activities, and management of private use of public lands at approximately 100 projects. Land-based support facilities including boat launching ramps, parking, and pedestrian access are important features of this work.

User Fees.

Support for camping and day-use recreation fees is offered through development and application of automated systems for registration of users, collection and analysis of trends data, and special feature capabilities including differential pricing, reservations, and credit card use. Automated systems are designed for use on site using personal computers.

Economic Impacts of Recreation Management.

Economic impacts of recreation-resource management and development of techniques for estimation of use beyond developed parks is currently in progress. Regional recreation demand models are also currently being developed.

Customer Satisfaction.

Methods for identification of needs and demands of the using public and for monitoring management to meet those expectations are currently in the development stages. (Contact: Mr. H. Roger Hamilton, 601-634-3724.)

B. Evaluation of Plant Growth Regulators for Turfgrass Management (EL-32)

Current research deals with the use of plant growth-regulating

compounds in grounds maintenance. The objectives of this research are to evaluate current growth-regulating chemicals for their effects on various turfgrass species (both warm- and cool-season); determine the cost-effectiveness of incorporating these products into grounds maintenance operations; and provide guidance on application techniques (including timing of application, chemical combinations, and rates) to achieve maximum growth-regulating benefits. Research topics of interest include identifying long- and short-term effects of plant growth-regulating chemicals on rooting, density, recuperative capacity, and disease susceptibility of various turfgrass species; methods to predict time of application on various turfgrass species (for example, growing degree day models); and effects of sequential and/or multiple application for season-long control of Southern turf species. (Contact: Dr. K. D. Getsinger, 601-634-2498.)

C. Insect Pest Management (EL-33)

Integrated control programs are being developed and tested for various aquatic (*Diptera*) and terrestrial (*Dictyioptera* and *Isoptera*) pest insects. Research should be directed toward the development of programs which utilize a multifaceted approach to control, including the use of biological pesticides as well as mechanical and cultural control practices. New and innovative approaches to control are being sought, especially those that utilize existing technologies incorporated into a working management program. (Contact: Dr. Alfred F. Cofrancesco, 601-634-3182.)

Cultural Resources

I. Introduction

As part of its mission responsibilities, the Corps of Engineers must maintain and manage millions of acres of land, much of it surrounding over 700 water resource development projects throughout the United States. This responsibility includes preservation of cultural and historical sites and resources. Technology that is developed for this purpose is provided to Corps Civil Works projects, as well as military installations and other cooperating Federal agencies.

II. Research Area

Preservation and Management of Cultural Resources (EL-34)

Archeological and historical sites are subject to a wide variety of detrimental impacts such as streambank and reservoir shoreline erosion, wind deflation, groundwater leaching, compaction, chemical contamination, animal burrowing, vehicular traffic, and vandalism. Additional research is needed to identify and evaluate site protection techniques and strategies for the Corps to consider in its construction and land management responsibilities. Through

experimental research and field demonstration projects, the Corps continues to seek to develop guidance on preservation methodologies that will preserve the integrity of sites and their contents, achieve compatibility of the methods with local environmental settings, permit monitoring of ongoing site status, and provide future scientific access to the sites. Research results should incorporate cost comparisons between various protection measures and evaluation of the potential side effects of the measures. Strategies for the transfer of technologies developed for site protection are also sought.

The need also exists for research in direct support of Cultural Resource Managers at Corps districts, Military installations, and other Federal agencies. Studies are under way to investigate problems associated with curation and with Native American consultation requirements. Other studies are focusing on information management tools, including the development of automated spatial and attributed databases for identifying, evaluating, and managing prehistoric and historic resources in both their regional context as well as site-specific situations. Current work also includes identification, evaluation, and stewardship of cultural resources as elements of wetland ecosystems and the application of nondestructive geophysical methods of site investigation, particularly when coordinated with GIS and GPS. The need exists for developing products to help cultural resource managers more efficiently meet all legal requirements for the above-mentioned areas. (Contact: Dr. Frederick L. Briuer, 601-634-4204.)

GEOTECHNICAL LABORATORY

I. Introduction

Research is performed by the Geotechnical Laboratory's four divisions in the areas of soil mechanics, rock mechanics, engineering geology, geophysics, earthquake engineering, seismology, pavements, expedient horizontal construction by engineer troops, expedient surfacing materials, and mobility of military vehicles. Only some of the areas of the laboratory's research responsibility are included in this announcement. The following sections more specifically describe those research areas in which pre-proposals will be considered.

II. Research Areas

A. Earthquake Engineering (GL-1)

Research areas of interest include the dynamic behavior of soil and rock; liquefaction of soils, including coarse-grained and fine-grained soils; in-situ testing to evaluate properties related to dynamic behavior; in-situ testing to evaluate susceptibility to liquefaction; methods of analysis of dynamic behavior of earth materials; methods of analysis of dynamic soil-structure interaction; risk-based and probability-based methods of analysis; seismic wave propagation in earth materials; seismically-induced settlements in soils; and remedial treatment of soils potentially susceptible to earthquake-induced instability or strength loss, computer visualization and dynamic simulation; site response analysis; and strong motion instrumentation. (Contact: Dr. M. E. Hynes, 601-634-2280.)

B. Geophysics (GL-2)

WES supports research in the development of geophysical methods to be used for characterization of hazardous waste sites, cavity/tunnel detection, detection and monitoring of seepage, location of groundwater, analytical and data processing techniques, borehole surveys, crosshole seismic imaging, electromagnetic detection of anomalies, seismic surveys, characterization of physical and mechanical properties of earth materials, and uses of microgravity. (Contact: Mr. J. R. Curro, 601-634-2235.)

C. Mobility of Military Vehicle (GL-3)

The Mobility Systems Division program addresses engineering research on the performance of military vehicles operating cross-country, on-road, and in negotiating dry and wet obstacles in worldwide terrains. This is a highly specialized technical area, involving engineering mechanics, vehicle dynamics, mathematics, statistics, computer specialties, geology, and soil mechanics.

1. Basic Mobility Research and Analysis

Research in this area is aimed at developing fundamental relations between soil and vehicle running gear; improving criteria concerning the effects of vehicle vibration on human response; developing algorithms describing weather effects on terrain, multi-vehicle movements along road nets, stochastic processes describing influence of uncertainties of data elements and developing modeling and simulation capabilities for near real time assessments of mobility and countermobility for battlefield operations and operations other than war. (Contact: Mr. Newell R. Murphy, Jr., 601-634-2447.)

D. Pavement Technology (GL-4)

Research is conducted in support of the Corps mission requiring the design and construction of Army and Air Force pavements, including airfields, worldwide and the military engineering function or operations of troops in the field as they relate to pavements and expedient surfacing. This involves the formulation of engineering criteria for the design, construction, evaluation, maintenance, and rehabilitation of permanent and expedient airfields, pavements, railroads and ports. Research areas of interest include improved design procedures, material characterization and evaluation, nondestructive testing, rapid repair of structures, expedient surfacing, aircraft and vehicular ground flotation, access/egress systems, gravel surfaced and non-surfaced areas, the use of geotextiles and geomembranes, grid confining systems, stabilization and dust control materials and techniques, and advanced binder systems. (Contact: Dr. Raymond S. Rollings, 601-634-3304.)

1. Material Utilization in Military Pavement Systems

Research in this area is needed to determine the field performance of new and waste materials in military pavements (both asphalt cement and portland cement concrete pavements) and tie them to specifications. Development of performance-based specifications will allow the quick integration of these new and waste materials into military construction projects and to streamline the current specification and procurement processes. These specifications will then be issued to field agencies of the DoD and industry so that these materials may than be used in military construction projects. (Contact: Dr. Raymond S. Rollings, 601-634-3304.)

E. Soil and Rock Mechanics (GL-5)

Research is needed to (a) develop improved methods for analyzing earth and rockfill dams and other water control structures for both static and earthquake-induced stresses; (b) improve the state of knowledge of physical and engineering properties of

clay shales; earth-rock mixtures, granular filters, cohesive and

noncohesive fine-grained soils susceptible to liquefaction, and soils susceptible to drastic volume changes (collapse, consolidation, swell); (c) develop rational analytical procedures and more reliable prediction of behavior of partially saturated soils; (d) determine the response of soils in situ to static and dynamic loading and unloading; (e) determine the susceptibility of earth dams to cracking, hydraulic fracturing, and internal erosion; (f) evaluate improved defensive design measures in use of materials, particularly in filter and transition zones and impervious barriers; (g) improve procedures for monitoring and analysis of the performance of new and existing structures, particularly the use and interpretation of observations and from specialized instrumentation, and expedient systems for rapid inspection and evaluation of the integrity of dams; (h) improve the understanding of the aging processes in dams and in the influence of aging (particularly deterioration of safety-related features) on long-term maintenance and/or rehabilitation requirements for dams; (i) develop a better understanding of failure mechanisms to improve design of defensive measures, to provide information for remedial repairs, to assess potential damages resulting from failure, and to provide a basis for emergency actions; (j) develop a rational approach to the assessment of dam safety by application of risk-based analyses in all aspects of dam design, construction, and operation; (k) develop expedient remedial measures when hazardous conditions are identified and thus reduce the damages and catastrophic potential of dam failures; (l) develop methodology to evaluate forces exerted on structural elements by adjacent soil masses that result from long-term variation in soil properties; (m) develop improved methodology for design and construction procedures for shallow and deep foundations, including mats, footings, piers, and piles for buildings, hydraulic structures and waterfront structures; (n) large scale physical and numerical modeling of deep underground structures (tunnels, shafts, chambers, intersections); (o) predictions of rock mass dredgeability; (p) acoustic emission (micro-seismic) applications in geotechnical engineering; (q) geotechnical aspects of hazardous and low level radioactive waste disposal; (r) erosion of rock in unlined emergency spillways; (s) evaluation of rock for use as rip-rap; (t) grouting of soil and rock masses; (u) sliding stability of gravity structures, and (v) centrifuge modeling of structures founded on or in rock. Technology transfer activities (i.e. demonstration projects, workshops, seminars, etc.) are included in this requirement. (Contact: Dr. Don Banks, 601-634-2630.)

F. Engineering Geology (GL-6)

WES conducts a broad range of research in the field of engineering geology in support of Corps of Engineers and other Army and federal technical missions. Specific areas of interest within this field include but are not limited to the following: application of remote sensing for geologic purposes; applied archeological

investigations; applied geomorphic analysis; borehole camera and borehole television applications; computer applications in geotechnical engineering; computer mapping systems; geographic information systems, geohydrology in military and civil applications; geologic mapping; geologic applications of mathematical and statistical techniques; groundwater monitoring, including well installation and design; solute transport and plume configuration analysis; integration of geological and geophysical subsurface exploration techniques; land-loss studies; remedial measures at groundwater contamination sites; seismic hazard characterization and evaluation; subsurface exploration methods (drilling techniques, sampling techniques); test site selection; waterborne subbottom profiling systems. (Contact: Mr. Robert J. Larson, 601-634-3201.)

STRUCTURES LABORATORY

The Structures Laboratory is responsible for planning and executing scientific and engineering research and development in the fields of structural design and performance of structures, weapons effects, earth dynamics, and concrete and construction materials. It is the lead laboratory for the Department of Defense in work on Survivability and Protective Structures. The research areas of its three divisions are outlined below.

GEOMECHANICS AND EXPLOSION EFFECTS

Structures Laboratory, WES, performs research on the behavior of earth and earth-structure systems subjected to intense transient loadings and the effects of explosions for application to military engineering. Research area also includes the measurement, processing, and analysis of seismic and acoustic signals to locate airborne and ground military targets and buried objects, and to characterize earth media. Research methods include laboratory-scale to large-scale field testing, and numerical modeling. (Contact: Dr. J. P. Balsara, 601-634-2291.)

Research Areas

I. Test Instrumentation Development (SL-1)

Recent advancements in precision-guided weapons have shifted the areas of concern for survivability/vulnerability assessment much closer to the explosion source. Consequently, transducer designs having the capability to record dynamic accelerations approaching one million g's and stress levels above 1.5 GPa are required. The gages must be able to survive multi-directional shock waves and large transient displacements. Gage design includes the internal measurement system, shock isolation materials, packaging, and data transmission cable connection or electronics. (Contact: Dr. C. R. Welch, 601-634-3297.)

II. Explosives Design for Excavation, Demolition, and Obstacle Creation (SL-2)

Current criteria for improved demolitions call for very significantly reduced manning levels, preparation times, and quantities of explosives to accomplish assigned missions. Cost effectiveness, versatility, and safety are also of great importance. Current efforts are directed at explosive technologies for the standoff creation and reduction of all types of battlefield obstacles, and the excavation of fighting positions. A prime consideration in these efforts is the development of more efficient means for the application of various types of explosives to targets of interest. In addition, modern materials and design principles used in typical target structures must be incorporated into future plans and guidelines for the use of demolitions. Typical missions of

interest are road cratering, antitank ditching, bridge and tunnel demolition, and the breaching of walls, bunkers, levees, and dams. (Contact: Mr. H. S. McDevitt, 601-634-2705.)

III. Explosive Storage Safety (SL-3)

The military services must store large amounts of munitions, both for war reserves and for training purposes. New conceptual designs for components or systems of storage are needed which will reduce the likelihood of an accidental explosion of stored munitions, limit the propagation of an accidental explosion, or mitigate the safety hazards produced by an accidental explosion. In addition, test data and simulation techniques are needed to aid in the definition of the safety hazards from such explosions, and the mechanics of explosion propagation among munition stores. Obsolete munitions are often disposed of by deliberate, controlled detonation. Research is needed on new methods for safe, efficient, and environmentally sound methods for explosion disposal of a wide variety of munition types. (Contact: Mr. L. K. Davis, 601-634-3323.)

IV. Physical and Numerical Simulation of Explosion Effects (SL-4)

The mechanical effects induced by nuclear detonations have been physically simulated using a variety of energy sources, but most frequently high-explosives. The high-explosive simulations have been performed at small (1/10 to 1/2) scale. The mechanical effects from conventional munitions and bare explosives have normally been performed at small scale using high explosives. These studies could benefit from improved (better fidelity, less expensive) simulators and simulation techniques. They could also benefit the development of test methodology for micro-scale (1/000 to 1/10) testing. Micro-scale test methodology includes the miniature high-fidelity energy sources, miniature sensors, advanced optical techniques, high-fidelity construction techniques for miniature structures, and theoretical developments in the scaling of material behavior.

Numerical simulations of explosion-induced mechanical effects (airblast, ground shock, water shock, surface waves, far-field seismic signatures, cratering, ejecta) use a variety of numerical methods including finite elements, finite differences, smooth-particle hydrodynamics, cellular automata, discrete deformation analyses, analytic closed-form solutions, and discrete elements. These methods are used with equation-of-state material models to solve the basic conservation laws of physics. Improvements in the numerical methods or material models, to improve their efficiency or accuracy, or broaden their range of application, would benefit studies which rely on numerical simulations. (Contact: Dr. C. R. Welch, 601-634-3297.)

V. Advanced Seismic and Acoustic Signal Measurements, Processing, Analysis, and Modeling (SL-5)

Research in this area is concerned with seismic and acoustic sensing, processing, analysis, and modeling of ground and air targets. Most sensing research applies to passive acoustic and seismic technology, but some limited amount of sensing is performed with active acoustic and seismic systems and passive magnetic, electromagnetic and even nuclear sensors. Measurements are performed using direct-contact acoustic and seismic sensors. Processing methods include array processing and other methods of calculating source direction, noise suppression, advanced adaptive processing, signal classification and identification, and advanced processing methods. Phenomena of interest include direct propagation within the same medium and propagation across boundaries, such as geologic layers and the air/soil interface (acoustic-to-seismic-coupling). Modeling includes phenomenology models of signal propagation and target signature models. Purposes of work are sensing, detecting, and locating airborne and ground military targets, buried objects, and medium characterization, and classifying and identifying sources based on their acoustic and seismic signatures. (Contact: Dr. Ben L. Carnes, 601-634-2231.)

VI. Smart Sensor Systems (SL-6)

Smart sensor systems being integrated from existing military and/or commercial off-the-shelf technology contain a variety of passive sensor types including acoustic, seismic, magnetic, infrared, and nuclear. Systems can include multiple sensors and computer chips that perform data acquisition, signal processing, and analysis on board. Results then are used to engage the target source with a munition (one specific application is smart mines) or are transmitted to some remote area, to an aircraft, or to a satellite. Models are needed that account for quantified terrain and environmental effects on the high-technology sensor systems, and provide system performance predictions for realistic worldwide terrain and environments. Sensor logics must be capable of target identification and false target rejection. (Contact: Dr. Ben L. Carnes, 601-634-2231.)

VII. Laboratory Tests and Constitutive Model Development for Geologic Materials (SL-7)

This research requires the formulation of mathematical constitutive models to simulate the mechanical behavior of geological materials and incorporation of models into application-oriented prediction/analysis techniques. Also of interest are the development of dynamic test equipment and techniques and experimental evaluation of geological material response to high-pressure transient loadings. (Contact: Mr. A. E. Jackson, Jr., 601-634-3530.)

VIII. Projectile Penetration (SL-8)

Theoretical and experimental studies of projectile stresses and trajectories due to impact and penetration into geologic and manmade targets and development of design criteria for shield systems. Includes development of equipment and diagnostic techniques to examine the response of targets to low and high velocity impact of penetrators, rods, etc. (Contact: Dr. B. Rohani, 601-634-2248.)

IX. Computational Structural Mechanics for DoD Applications (SL-9)

The efficient utilization of scalable computers will require fundamentally new concepts in computational mechanics algorithms. Research includes mathematical formulations and development of scalable computational mechanics algorithms in the areas of structural response, penetration, contact-impact, explosion, structure-medium interaction and interdisciplinary flow-thermal-structural interactions. Research area also includes development of computational models for new materials and composite construction (consisting of concrete, composite, and/or geologic materials) as well as the behavior and control of structures composed of such composite construction for military applications. (Contact: Dr. R. Namburu, 601-634-3811.

CONCRETE AND MATERIALS RESEARCH

Research on concrete and cement by the Corps of Engineers is for the most part related directly to immediate needs and applications. However, there is growing recognition of the necessity of basic research to improve and advance the field in directions for which immediate application may not yet be obvious. The following areas of inquiry on cement and concrete are related to current research programs or recognized needs. These include both military and civil applications. A major objective of the Army Civil Works Concrete Program is to investigate concrete mixtures and individual components of concrete, to determine how these may be used effectively to improve performance of both new and older concrete structures, and to evaluate new concrete materials and practices. Basic research on the reasons for observed characteristics and behavior of concrete mixtures is a natural outgrowth of this objective. Much of the research and development is applicable to military needs and projects. Military expediency focuses additional attention on ease and speed of concrete placement, development of very high strength, and use of non-traditional, indigenous, and other special materials in concrete construction. These interests open many new fields in which basic and applied research is needed. (Contact: Dr. Paul Mlakar, 601-634-3251.)

Research Areas

X. Concrete Materials (SL-10)

Aggregates comprise as much as 80 percent of the volume of concrete. Characteristics and behavior of various types of aggregates, and chemical and physical interaction among aggregates on other concrete components, are critical to overall concrete performance. Research areas include: nature of and potential for reactions between aggregates and alkalies; significance of and techniques for regulating aggregate moisture content; importance of aggregate shape and size distributions; and contribution to concrete durability. Optimizing the use of marginal natural aggregates, such as those with high clay contents of low structural integrity, also could be investigated, as could use of man-made aggregates such as recycled concrete.

Use in concrete of by-products of other industrial processes, such as fly ash, silica fume, and ground granulated blast-furnace slag, is increasing with knowledge of the potential benefits to concrete properties. These uses contribute to solutions of industrial waste disposal problems, while enhancing potential for development of new types of concrete with properties tailored to special uses. Knowledge of the mechanisms by which these materials interact with cement, aggregates, and other concrete ingredients, is essential. Effects of these materials on concrete strength and durability is another area of particular research interest, as is use of cementitious materials other than portland cement, including some fly ashes. Additional research is needed, leading to establishment of optimum quantities of pozzolans and cement in concretes for general and special uses.

More specialized uses of concrete and increased demands on concrete performance have increased the importance of chemical admixtures such as water-reducers, set retarders, set accelerators, air-entraining admixtures, and foaming and defoaming agents. The mechanisms by which many of these admixtures function are virtually unknown.

Reinforcing in concrete is critical to much of concrete design and construction. Research areas include materials and methods of reinforcing, corrosion of reinforcing materials, and performance of reinforced concrete in severe environments (freezing and thawing, chloride penetration, and elevated-temperature environments). Materials and methods for production of fiber-reinforced concrete merit study.

Polymer concretes are being used both for restoration and new construction. Interaction among components of these composite materials, and the ranges of characteristics that could be achieved with different combinations of materials, are little known. Research areas include polymer-impregnated concrete, polymer or

resin concrete, or polymer-portland-cement concrete.

Research also is needed on means of formulating concretes to achieve specified performance, such as concretes with very high tensile or compressive strength, expansion, rapid hardening, resistance to abrasion and erosion, shock-attenuating properties, ultra-light weight, ability to float indefinitely, or thermal insulation properties.

There is growing interest in the possibility of biochemically produced cementitious materials.

XI. Concrete Properties and Analyses (SL-11)

New technologies continually are being developed for non-destructive testing of various materials. Development of new methods could lead to applications in analysis of properties and performance of concrete. Links must be developed between the sophisticated testing methods and the needs of concrete technology. New dielectric, piezoelectric, or ceramic composites, for example, may appropriately be used in new concrete test methods, if these links are made.

Many of the research areas outlined in the previous paragraphs are related to methods of testing and analysis of concrete. Consideration of aggregate quality and moisture content, use of other admixtures, all apply to analytical considerations. In addition, investigations are needed of new methods, and modifications to existing methods and apparatus for testing concrete materials and structures. This need derives partially from uses of new materials. Special use concretes and technologies such as placement of roller-compacted concrete also demand new testing technologies.

Thermal properties of concrete, and the heat generated during curing of mass concrete also are related to many of the above considerations. Understanding heat generation, and thermal and mechanical stresses, will require computer-assisted modeling of concrete performance.

Other research needs in testing and analysis include:

A. Determine critical materials for minimizing cracking in concrete, and develop materials-based guidelines for predicting concrete performance. This includes developing criteria for predicting durability and longevity of concrete and grout.

B. Classification of chemical admixtures by chemical composition and mechanism of performance.

C. Development of methods of artificially accelerated curing of concrete, and new means of simulating real-world conditions and

long times.

D. Development of innovative systems to construct concrete structures more economically.

E. Development of theoretical, computational, and experimental methods for effectively characterizing stress, strain, progressive damage, and fracture of engineering materials subjected to static and dynamic loads.

XII. Maintenance, Repair, and Rehabilitation of Concrete Structures (SL-12)

Assessment of remaining life, maintenance and minor remedial measures, repair and rehabilitation, and surveillance and monitoring are topics of interest. Structures of interest include concrete locks and dams and appurtenant concrete and steel structures (outlet works, retaining walls, gates, piles, bulkheads, tunnels, intakes, etc.). (Contact: Mr. William F. McCleese, 601-634-2512)

XIII. Other Areas of Research (SL-13)

Materials which are not actually components of concrete are nevertheless important in some concrete applications. Basic research is needed on the properties and performance of such materials as: curing compounds, coatings, and overlays; epoxy resins, or other agents for improving bond between old and new concrete; waterstop materials for use in hydraulic structures, and methods of characterizing and testing such materials; grouts for injection underground in very fine fracture systems or porous media; organic and inorganic composites that are used in construction.

Grouts and concretes are being used at present for disposal of hazardous, toxic, and nuclear wastes. This use is likely to increase, and research is needed on optimum proportions for cement-based materials for waste-disposal technology. In addition, grouts and concretes will be important in disposal of both commercial and defense-related low-level and high-level radioactive wastes. Additional basic research is required on the behavior of cement-based materials in the probable geologic conditions of this disposal, and radioactive conditions.

STRUCTURES RESEARCH

Structures Laboratory conducts research involving development, testing, and evaluation of a broad class of structures to resist the effects of static and dynamic loads induced by the detonation of nuclear and conventional weapons, high-explosives, earthquakes, and other sources. It is also responsible for research in fixed installation camouflage, concealment, and deception. (Contact: Dr. Reed Mosher, 601-634-3956.)

XIV. Structures Research (SL-14)

A. Research is needed to develop design and analysis methods for eliminating or reducing structural vibration of steel gates subject to flow conditions that have the potential to induce structural vibrations.

B. Part of the new Earthquake Engineering Research Program will be to support the Corps' inventory of concrete dams in high seismic zones. Research is needed to develop validated nonlinear design and analysis tools for gravity and arch dams. The concrete may be placed with conventional techniques or with roller-compacting procedures. Also, research is needed in the area of ductility of lightly reinforced concrete members in order to evaluate existing intake towers during a maximum credible earthquake.

C. Research is needed in the general area of structural reliability and risk analysis for assessing sensitivity of structural design and analysis procedures, vulnerability of structures, and assessment of critical design parameters to develop appropriate load resistance factors.

D. Nonlinear and linear system identification research is needed for supporting and improving current vibration testing, data acquisition, data processing, and analysis techniques for determining linear and nonlinear dynamic and static response properties of structures and structural systems subjected to earthquakes, blast effects from mining (or other) operations, other transient random, harmonic dynamic loads, and static or pseudostatic loads.

E. Research is needed to develop simplified and advanced computerized methods for soil-structure interaction (SSI) analysis. Methods needing investigation include Winkler and Pasternak methods, non-linear finite element method and boundary elements. The SSI techniques are to be applied to shallow and deep foundations, wall, and U-frame structures.

F. Research is needed related to development of computer programs for design of hydraulic structures and related structures to support the Corps Civil Works mission. Such structures include miter gates, tainter gates, floodwalls, retaining walls, pile group, sheet piles, cellular cofferdams, culverts, and conduits.

XV. Structures Research (SL-15)

A. Response of above-ground and shallow-buried structures to loads either from nuclear or conventional weapons. Specifically the prediction of the load and response to failure of above-ground and shallow-buried structures from nuclear weapons and internal and external detonations of conventional weapons. This effort will involve the following research:

1. Development of techniques to simulate loads on above-ground and mounded structures from conventional and nuclear weapons.

2. Development of design procedure for components in semihard and protected facilities to conventional weapons effects.

3. Analysis of structural loading and damage resulting from internal detonations.

B. Research on deeply based structures and hardened existing systems involving the following:

1. Development of comprehensive structural design for deeply-buried and surface-buried structures subjected to airblast-induced, and direct-induced ground shock from surface and shallow earth-penetrating nuclear and conventional weapons.

2. Formulation of computer models for soil-structure interaction and pre- and post-test analysis of structural response to include correlation and comparison with experimental data.

C. Research on surveillance and intrusion detection sensors involving the following: This program concerns research on the constraints of the environment on sensor systems used to detect intruders and along the perimeter of high-value military installations. For this purpose, improved methods for rapid and accurate measurement of predetermined influential environmental parameters must be developed. Also, analytical techniques relating to specific, sensing phenomenologies and target/nontarget generated signatures and signature wave interactions to variations in environmental characteristics are required. Of particular interest is the integration of multiple sensor systems (both detection-type and environmental/background monitoring transducers), which utilize various sensing phenomena for enhanced target detection and classification and increase nuisance and background signature rejection. Also, research studies are required in the determination of automated techniques for monitoring sensor system response and sensitivity to provide optimum and consistent performance as a function of time varying changes of influential environmental characteristics.

D. The CE is involved with research on the design of military facilities for protection from conventional and terrorist weapons. These efforts include the following research:

1 . Prediction of the response of structural elements common to conventional or expedient construction to combined blast loads and fragment impact.

2. Methods of retrofitting conventional buildings to harden them to nearby detonations of blast/fragmentation weapons.

3. Development of innovative design of structural components, such as windows and doors, subject to high-explosive loads.

4. Development of analytical methods for predicting the effects of forced entry devices on structural components.

5. Development of innovative designs using lightweight materials for expedient protection of troops, weapons systems, and equipment from the effects of blast and fragmentation.

6. Development of micro-processor-based software/ hardware and supporting documentation to aid in the assessment of structural survivability to the effects of conventional and advanced weapon systems. The software will address the integration of databases, weapons effects calculations, and operational factors associated with engineer survivability missions.

7. Development of a procedure to ensure robust codes, user-friendly interfaces, and supporting documentation for use in the testing and development of micro-processor-based survivability and structural assessment software/hardware.

XVI. Research Areas (Multispectral Fixed Facility Camouflage) (SL-16)

A. This area involves work on all aspects of fixed facility camouflage, concealment, and deception (CCD). Fixed facilities include stationary and relocatable targets. Normally, only high-asset facilities (a Commander decision) are of interest for protection. The general goal is to directly and indirectly increase the survivability of US and Allied facilities and reduce the survivability potential of adversaries' CCD'd targets. Multispectral refers to those areas of the electromagnetic spectrum used by US and potential adversaries in reconnaissance and surveillance and in attack platform target acquisition and detection. This particularly applies to the visual, infrared, and radar bands of the electromagnetic spectrum. Other bands used in current and new design attack platforms and special air breathing reconnaissance platforms as well as narrow-band sensors are also of interest. Bands applicable to signals and human intelligence (SIGINT and HUMINT) are of lesser interest. Major objectives of work include quantifying or otherwise evaluating CCD technology multispectral effectiveness; investigating materials and techniques for signature modification; developing decoy concepts, procedures, and applications; developing computer based analytical procedures for simulating scenes, particularly micro-processor-oriented models and systems that will become a part of an analytical camouflage design and evaluation; developing instrumentation for and the conduct of target/background signature measurements; assessing US and threat operations and sensor capabilities with

both currently fielded and new design reconnaissance and surveillance and attack platform sensors and systems; developing applications for intelligence information for military conventional and non conventional missions; providing guidance to field commanders and information for RDTE community; and studies of the interaction of camouflage technology with other operational factors, particularly in determining operational supportability, costs and manpower, interoperability, and joint interoperability requirements. Major objectives apply both to increasing survivability through defense and improving the US and Allies' current counter-CCD capability. Some types of activities require work on the WES facility, and others require work off-site within and outside the US. Work is required on the following topics.

B. Quantify or otherwise evaluate CCD technology multispectral effectiveness. Quantification of the effectiveness of CCD for increasing survivability of selected facilities and assets against attacks. Emphasis is on manned tactical systems on fixed and rotary winged platforms, involving the range of current and near-term planned weapons that are available for use by potential adversaries, including precision guided weapons. Intelligence systems and the intelligence process are also of prime interest since the use of these processes results in the targeting process and attack.

The development and application of analytical techniques for gathering and interpreting data from different Time, Space, and Position Information (TSPI) systems, head-up display video recordings, sensor video recordings, questionnaires, and multispectral overhead imagery. Primary emphasis regarding TSPI systems is concentrated on Air Combat Maneuvering Information (ACMI) systems, Tactical Aircrew Training Systems (TACT), and variations on the Air Force RAJPO Geographic Positioning System (GPS) systems as well as emerging GPS systems. The interpretation of CCD effects from the imagery, the measurement of x,y,z,t data using fiducial-based measurement software with imagery, and the ability to review x,y,z,t and imagery data to determine measurement conditions are examples of TSPI and imagery uses.

Development and application of measurement procedures to determine attacker target acquisition, target designation, weapon release locations, and weapon aimpoint errors. Such capabilities are essential in the determination of CCD effectiveness.

C. Investigate materials and techniques for signature modification. Signature measurements may be both ground-based and aerial and may also include scale-model measurements, particularly for some of the radar bands. Calibrated measurements are preferred not only for typical fixed-facility target types but also for typical target backgrounds. Target types may include thin-walled metal buildings, concrete structures, earth-covered facilities, and hardened and paved horizontal surfaces. Backgrounds may include

desert, forests, grass, bare soil, croplands, snow, etc.

Signature manipulation materials and techniques may include coatings, nets and screens, structural modifications and the use of energy absorbing, reflecting or frequency and emissivity shifting materials. Studies should focus on quantitative measures of effectiveness as well as operational, economic and environmental considerations.

D. Develop decoy concepts, procedures, and applications. Generation of concepts, materials, and techniques leading to the development of rapid deployment, high resolution decoys designed to emulate a fixed or relocatable facility. The decoy design should consider the replication of facility signature characteristics in the visual, thermal, and radar portions of the electromagnetic spectrum. Economic and environmental considerations related to material production and deployment should be considered, and experimental designs and material descriptions developed.

E. Develop computer based analytical procedures for simulating scenes, particularly micro-processor-oriented models and systems that will become a part of an analytical camouflage design and evaluation. Micro-processor-based software/hardware development are required to help support the implementation of a multispectral Camouflage, Concealment, and Deception Design Research Work Station. The following kinds of models will be needed:

1. Fixed-facility/background scene generation through the use of signature prediction models coupled with data base look-up techniques.

2. Scene modification through the application of digital and fractal design procedures to include new camouflage counter measures.

3. Target identification including target/background contrast algorithms.

4. Sensor performance models.

F. Develop instrumentation for and conduct target/ background signature measurements. Procedures for target/scene characterization are required for all conventional and unconventional missions "target" configurations. This includes the design and application of sensors, data gathering, and data analysis procedures applied to the target-in-scene situation. Such data and information are essential in the interpretation of the sensor and operations data and in other areas such as the calibration of models.

G. Assess US and threat operations and sensor capabilities with both currently fielded and new design reconnaissance and

surveillance and attack platform sensors and systems.

Development (and/or modification of accepted Joint and Armed services) procedures for determining target probability of survival, and the application of those procedures as a critical part of evaluating CCD alternate design in comparison with no use of CCD.

Smart weapons capabilities involving a two stage process of targeting using reconnaissance and surveillance followed by weapons delivery and autonomous weapon or warhead aiming and delivery.

Multispectral threat assessments should deal not only with describing existing and anticipated sensor systems but also defining how they will be used. Of primary concern are air-to-ground sensors and terminal guidance systems that might be employed against US/Allied targets.

H. Develop applications for intelligence information for military conventional and non conventional missions. Evaluation of operations, operational practices with sensors, and capabilities of long to short range reconnaissance and surveillance systems. Research on new design and new concept sensors to meet changing military conventional and non-conventional missions. Man-in-the loop sensors specifically include, but are not limited to National assets. The process involving the use of National assets is of interest through the target nomination process (for the conventional military mission). Multispectral imagery from separate sensors and single-sensor multispectral imagery is of special interest.

I. Provide guidance to field commanders and information for RDTE community.

Evaluation of Armed forces training with a goal of improving defensive and offensive operations in technology transfer of research findings to the Armed forces.

Development of input to war games and models at all levels of resolution. This includes model validation, use of empirical data in place of analytical models, development of analytical models, and development of hybrid models.

J. Study the interaction of camouflage technology with other operational factors, particularly in determining operational supportability, costs and manpower, interoperability, and joint interoperability requirements. Suitability issues related to the compatibility, cost effectiveness, and interoperability of effective CCD measures to ensure CCD equipment and techniques are operationally possible and meet Commanders' operations requirements. (Contact: Mr. Kenneth G. Hall, 601-634-3627.)

INFORMATION TECHNOLOGY LABORATORY

I. Introduction

The Information Technology Laboratory (ITL) performs research in computer-aided engineering, interdisciplinary engineering areas, computer science, and in all aspects of information technology. Projects include computer-aided structural engineering, application of computer-aided design and drafting (CADD) and geographic information systems (GIS) technology, 3-D structural stability, finite element method analysis, engineering reliability, relational data base management, management information systems, information engineering, software engineering, groupware systems, information center concepts, telecommunications, scientific visualization (including virtual reality), high performance computing/networking, office automation, graphic arts and publishing, library systems, and records management. (Contact: Mr. Timothy D. Ables, 601-634-3506.)

II. Research Areas

A. Computer-Aided Engineering (ITL-1)

Through the Computer-Aided Structural Engineering (CASE) Project, research is done in development of computer programs for design of structures utilized in the Corps Civil Works mission. Research is performed related to risk analysis, engineering reliability, and computer science techniques to enhance computational capabilities for solution of scientific and engineering problems. Computer graphics is studied extensively in areas of pre- and post-processors. Solid modeling techniques are being studied for 3-D structure representation. Accuracy of computational results is a matter of deep concern for many of the numerical procedures used by WES and other Corps offices. Innovations in numerical analysis are continuously investigated to save costs in computer time and ensure confidence in computation results, especially as applied to different size computers. Interface systems for electronic transfer of computer generated drawings between minicomputer- and microcomputer-based hardware are of concern. Military related work includes development of systems for computer-aided building design, masonry structures, and interfaces with drafting and architectural systems. (Contact: Mr. Wayne Jones, 601-634-3758.)

B. Information Technology (ITL-2)

Research and applied analysis are performed in optimization technology of Data Base Management Systems (DBMS) with special emphasis on technology surrounding the general fields of concurrent and other advanced access methods, innovative data structures and storage techniques, schema and sub-schema organization, overall system performance analyzing installation-specific hardware/

software interaction, and virtual simulation of DBMS models and data structures. Studies and evaluations are being conducted on state-of-the-art software engineering methodologies advocated by researchers in universities and industry. Investigations may be made on programming languages, experimental language extensions; design and implementation methodologies of operating systems; performance of computer systems, software systems, and programs; and advanced concepts in computer systems architecture that are potentially valuable to Corps offices. Studies are under way on Artificial Intelligence/Expert Systems in terms of their broadest definition; i.e., the use of computers to solve problems that previously could be solved only by the application of human intelligence. Techniques for applying mathematical modeling and/or digital simulation modeling to classes of problems and to specific problems is another area of interest. Research is being conducted in optimum design of microcomputer-based engineering work-stations including components for voice recognition and synthesis, pattern recognition, digitizing, data base management systems, and computer graphics. Of extreme importance is research in all areas of telecommunications including voice, data, video, and satellite using state-of-the-art technology. (Contact: Dr. Windell Ingram, 601-634-2182.)

Research is planned in automation of media presentation including current and planned capabilities, considering areas such as report generation, file transfer editing, graphic arts, slide production, document layout, and printing. Electronic flow of report information through all necessary channels without hardcopy is especially of interest. Additional research is planned in other information technology areas such as scientific visualization, advanced topics in data, voice and video transmission using evolving communication systems, information center concepts, management and business automation, visual information, library science, and records management. The information explosion has led to the necessity for better technology using fourth or fifth generation methods. (Contact: Mr. Murray Huffman, 601-634-3661.)

C. Computer-Aided Design and Drafting/Geographical Information System Technologies (ITL-3)

Through the Tri-Service CADD/GIS Technology Center, research is performed to support the application of CADD (Computer-Aided Design and Drafting) and GIS (Geographic Information Systems) technologies in new and existing mission areas of the Army, Navy, and Air Force. CADD/GIS capability is being widely integrated in the planning, engineering, construction, and facility management responsibilities of the three Services. Due to the expanding development of computer methods to meet the demands of technological advancements, interfacing these methods with CADD/GIS platforms is especially crucial. As the usage of CADD/GIS evolves and expands, the need to integrate other existing design and analysis computer tools, including relational data bases, spatial data

analysis, automated cost estimating and specification generation, etc., with CADD/GIS systems and evaluating new CADD/GIS applications for use by the three Services are of primary interest. Applications would be expected to interface with a variety of CADD/GIS platforms including, UNIX-, Windows 95, Windows NT, and DOS systems used by the three Services. Other research could include productivity studies, scope and criteria requirements for new technology development, self-instructional training guides, pilot projects in technology usage, etc. (Contact: Mr. Harold Smith, 601-634-4190.)

D. Engineering Guidance Update (ITL-4)

To support the Civil Works Guidance Update Maintenance Program, methods, technology, and procedures are being developed for technology transfer of research products, analysis and design methods, and computer-aided engineering into state-of-the-art integrated engineering guidance for the Corps of Engineers Civil Works Program. State-of-the-art methods for electronic document, publishing, archiving, transmission, and retrieval using Standard Generalized Markup Language (SGML), multimedia, hypertext, CD-ROM, Internet and electronic publishing are being developed. (Contact: Mr. Chris Merrill, 601-634-3588.)

E. High Performance Computing (HPC) and Networking (ITL-5)

Through the Department of Defense (DoD) HPC Center at ITL, research is performed to support the application of advanced HPC systems and networking technologies to Science and Technology (S&T) research and development (R&D) efforts within DoD. Of special interest is the application of scalable parallel architectures and associated algorithms to DoD S&T R&D applications; and also emerging network technologies and distributed storage technologies/ methodologies which will permit transparent sharing/applications of heterogeneous HPC systems located at WES and remotely throughout the DoD. (Contact: Mr. Stephen Adamec, 601-634-2901.)

PART II

REVIEW OF PRE-PROPOSALS AND EVALUATION OF PROPOSALS

A. Upon receipt of a pre-proposal (not to exceed 5 pages), the WES staff will perform an initial review of its scientific merit and potential contribution to the Army mission and also determine if funds are expected to be available for the effort. Offerors of pre-proposals of interest will be encouraged to submit a full proposal (in the format outlined in Part III) and these proposals will be evaluated in accordance with the criteria in paragraph B.

B. Proposals submitted in response to this BAA will be evaluated as received, using the following factors:

1. The overall scientific and/or technical merits of the proposal.

2. The potential contributions of the effort to the WES mission.

3. The offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

4. The qualifications, capabilities, and experiences of the proposed principal investigator, team leader, and other key personnel who are critical to achievement of the proposal objectives.

5. The reasonableness and realism of proposed costs and fee if any, and the availability of funds.

C. Pre-proposals and proposals not considered to have sufficient scientific merit or relevance to the Army's needs or those in areas for which funds are not expected to be available may be declined without further review.

PART III

PRE-PROPOSAL AND PROPOSAL PREPARATION

SECTION 1 - INTRODUCTION

This part is intended to provide information needed in preparing research proposals for submission to WES.

Organizations or individuals interested in submitting research proposals to WES are encouraged to make preliminary inquiries as to the general need for the type of research effort contemplated before expending extensive effort in preparing a detailed research proposal or submitting proprietary information. Points of contact are listed with the specific research areas for each laboratory. The research proposal often represents a substantial investment of time and effort by the offeror, and it should present the proposed research effort in sufficient detail to allow WES to evaluate the scientific merit and relevance of the proposed research.

Pre-proposals and proposals must reference the code number for the specific research area.

SECTION 2 - GENERAL INFORMATION

A. DEFINITIONS:

Short Form Research Contract (SFRC). A simplified form of contracting described in Subpart 235.015-71 of the Defense Federal Acquisition Regulation Supplement (DFARS). As authorized by Reinvention Laboratory Initiative No. WESCT-94-07, this form may be used for all contracts awarded under this BAA, including fixed-price contracts and contracts with commercial organizations.

B: REPORT REQUIREMENTS:

The number and types of reports will be specified in the contractual document. The reports will be prepared and submitted in accordance with WES report procedures which will be provided the awardee.

C. PROPOSAL PREPARATION AND SUBMISSION:

In preparing pre-proposals and proposals it is important that the offeror keep in mind the characteristics of a suitable proposal acceptable for formal evaluation. It should include all the information specified in this announcement in order to avoid delays in evaluation.

Pre-proposals and full proposals should be mailed to:

Commander
U.S. Army Engineer Waterways Experiment Station
ATTN: CEWES-CT-Z
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Proposals should be submitted on DD Form 2222-1 and 2222-2 (Short Form Research Contract) as defined in paragraph A of this Section 2. Copies of these forms are included in this announcement.

SECTION 3 - TYPE OF CONTRACT

Selection of the type of contract is based upon various factors, such as the type of research to be performed, the contractor's experience in maintaining cost records, and the ability to break out and allocate proposed costs and performance of the work.

A document commonly used because of its flexibility in supporting research, is a cost-reimbursement type contract. This type contract permits reimbursement for actual costs incurred in accomplishment of research. It also permits some flexibility in the redirection of efforts due to recent research experiment results or changes in Army guidance.

Fixed-price contracts are used when the research projects costs can be estimated accurately, the services to be rendered are reasonably definite, and the amount of contract-furnished property, if any, is fixed.

Contracts awarded by WES will contain, where appropriate, detailed special provisions concerning patent rights, rights in technical data and computer software, reporting requirements, equal employment opportunity, etc.

SECTION 4 - CONTENTS OF PRE-PROPOSALS

Pre-proposals should be limited to five pages. Five copies are requested. The pre-proposal should contain the following:

1. A title descriptive of the research to be performed.

2. The name and address of the individual, company or educational institution making the pre-proposal.

3. The name and phone number of the principal investigator or senior researcher who would be in charge of the project.

4. The duration of the project.

5. The estimated labor cost, materials cost, burdens, and profit (if any).

6. One or more paragraphs describing the objective(s) of the proposed research to include statement of the working hypothesis to be proved or disproved, if appropriate.

7. One or more paragraph describing the approach to be taken in the course of the research. If experimental, it should include a description of the scope of the testing program; if analytical, it should include key assumptions to be made, the scientific basis for the analysis, and the numerical procedures to be used.

8. One or more paragraphs describing the potential military and/or civil payoffs that might ultimately derive from the proposed research to the Corps of Engineers.

9. A one-page curriculum vitae of the principal investigator.

SECTION 5 - CONTENTS OF FULL PROPOSALS

Proposals should be furnished in five copies and contain the following:

TECHNICAL

The technical portion of the proposal should contain the following:

1. A complete discussion stating the background and objectives of the proposed work, the approaches to be considered, the proposed level of effort, and the anticipated results/products.

2. The names, brief biographical information, experience, and a list of recent publications of the offeror's key personnel who will be involved in the research.

3. The names of the agencies to whom the proposal has also been submitted.

4. A brief description of offeror's organization.

COST

The cost portion of the proposal should contain a cost estimate for the proposed effort sufficiently detailed by element of cost for meaningful evaluation. The estimate should be broken down for each year of the proposed work and should include the following:

1. A complete breakdown of direct labor to include, by discipline or individual, hours or percentage of time and salary.

2. Fringe benefits rate and base.

3. An itemized list of equipment showing cost of each item.

4. Description and cost of expendable supplies.

5. Complete breakdown of travel to include air fare, per diem, rental car, etc.

6. Complete breakdown of any subcontracts.

7. Other direct costs (reproduction, computer, etc.).

8. Indirect cost rates and bases with an indication whether rates are fixed or provisional and the time frame to which they are applied.

9. Proposed fee, if any.

The offeror's cost proposal may be submitted on SF 1411 a copy of which is included in this announcement. In addition, offerors should furnish the name and telephone number of the cognizant audit agency if they have been audited.